US009113894B2

(12) **United States Patent**
Perry

(10) **Patent No.: US 9,113,894 B2**
(45) **Date of Patent: Aug. 25, 2015**

(54) **VEIN PRESENTATION ENHANCEMENT DEVICE**

(76) Inventor: **Robert J. Perry**, Oklahoma City, OK (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 489 days.

(21) Appl. No.: **13/478,945**

(22) Filed: **May 23, 2012**

(65) **Prior Publication Data**

US 2013/0238013 A1 Sep. 12, 2013

Related U.S. Application Data

(63) Continuation-in-part of application No. 12/470,404, filed on May 21, 2009, now abandoned.

(60) Provisional application No. 61/054,961, filed on May 21, 2008.

(51) **Int. Cl.**

A61M 5/315	(2006.01)
A61B 17/135	(2006.01)
A61B 5/15	(2006.01)
A61M 5/42	(2006.01)
A61B 5/154	(2006.01)
A61M 25/06	(2006.01)

(52) **U.S. Cl.**

CPC ***A61B 17/135*** (2013.01); ***A61B 5/1438*** (2013.01); ***A61B 5/15003*** (2013.01); ***A61B 5/154*** (2013.01); ***A61B 5/150351*** (2013.01); ***A61B 5/150992*** (2013.01); ***A61M 5/31501*** (2013.01); ***A61M 5/31505*** (2013.01); ***A61M 5/31526*** (2013.01); ***A61M 5/42*** (2013.01); ***A61M 5/425*** (2013.01); ***A61M 5/427*** (2013.01); *A61M 5/31511* (2013.01); *A61M 25/0631* (2013.01); *A61M 2005/31508* (2013.01)

(58) **Field of Classification Search**

CPC ... A61M 5/31526; A61M 5/42; A61M 5/425; A61M 5/427; A61B 5/154; A61B 17/135; A61B 5/15003; A61H 9/0078; A61H 9/0092

See application file for complete search history.

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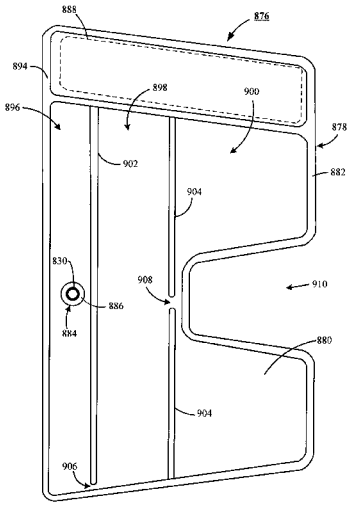
(74) *Attorney, Agent, or Firm* — San Diego IP Law Group LLP

(57) **ABSTRACT**

Preferably, an embodiment of a vein presentation enhancement device includes at least, an interior cover supporting a first fastening member, and an exterior cover communicating with the interior cover, wherein the exterior cover provides a first securement member that interacts with the first fastening member to secure the preferred device positioned about a limb of a subject. The preferred embodiment further includes a bladder formed between the interior and exterior covers, and an air transfer assembly connected to said bladder for transfer of air into and out of said bladder, wherein said interior and exterior covers collectively provide a plurality of projections defining a blood access window.

8 Claims, 28 Drawing Sheets



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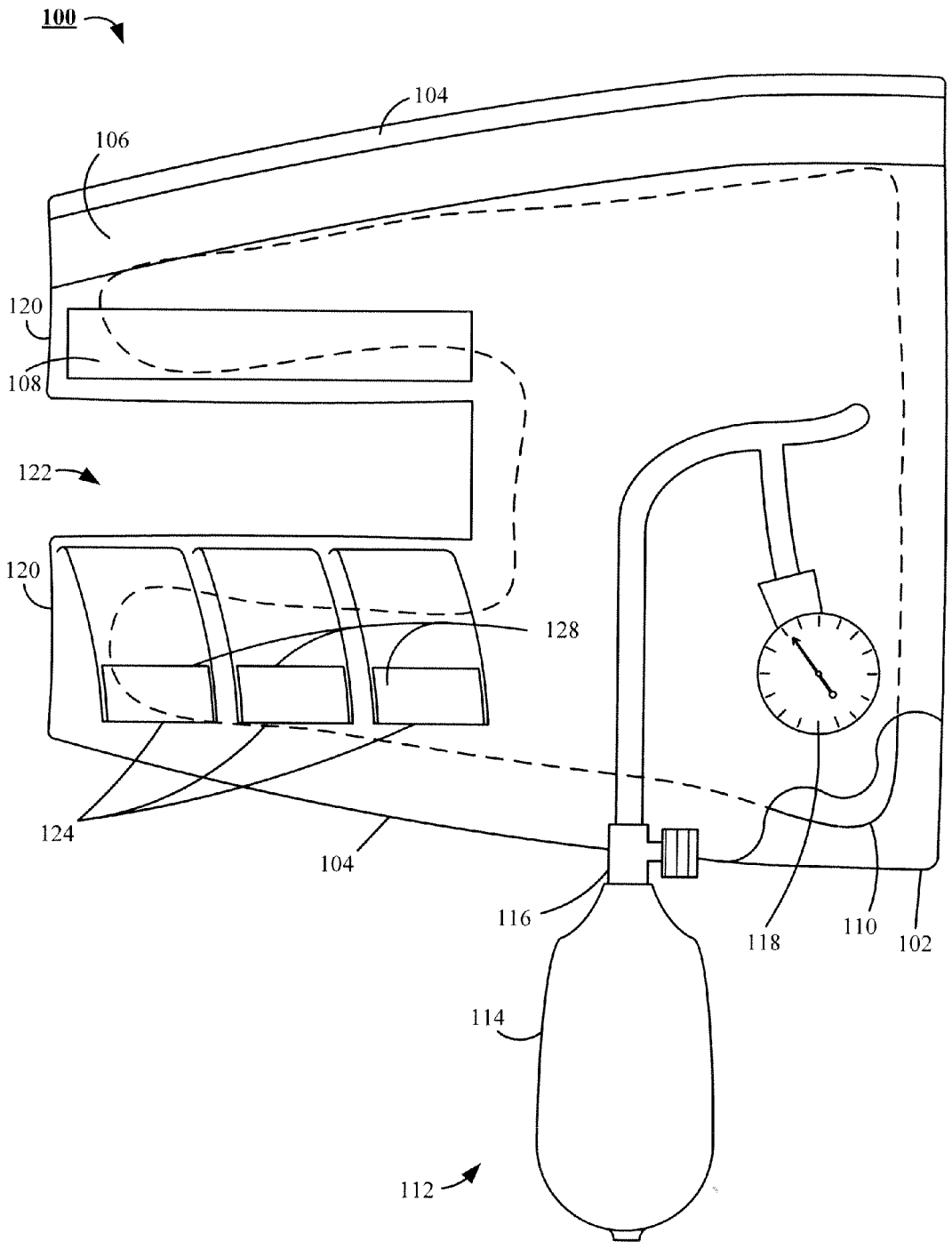


FIG. 1

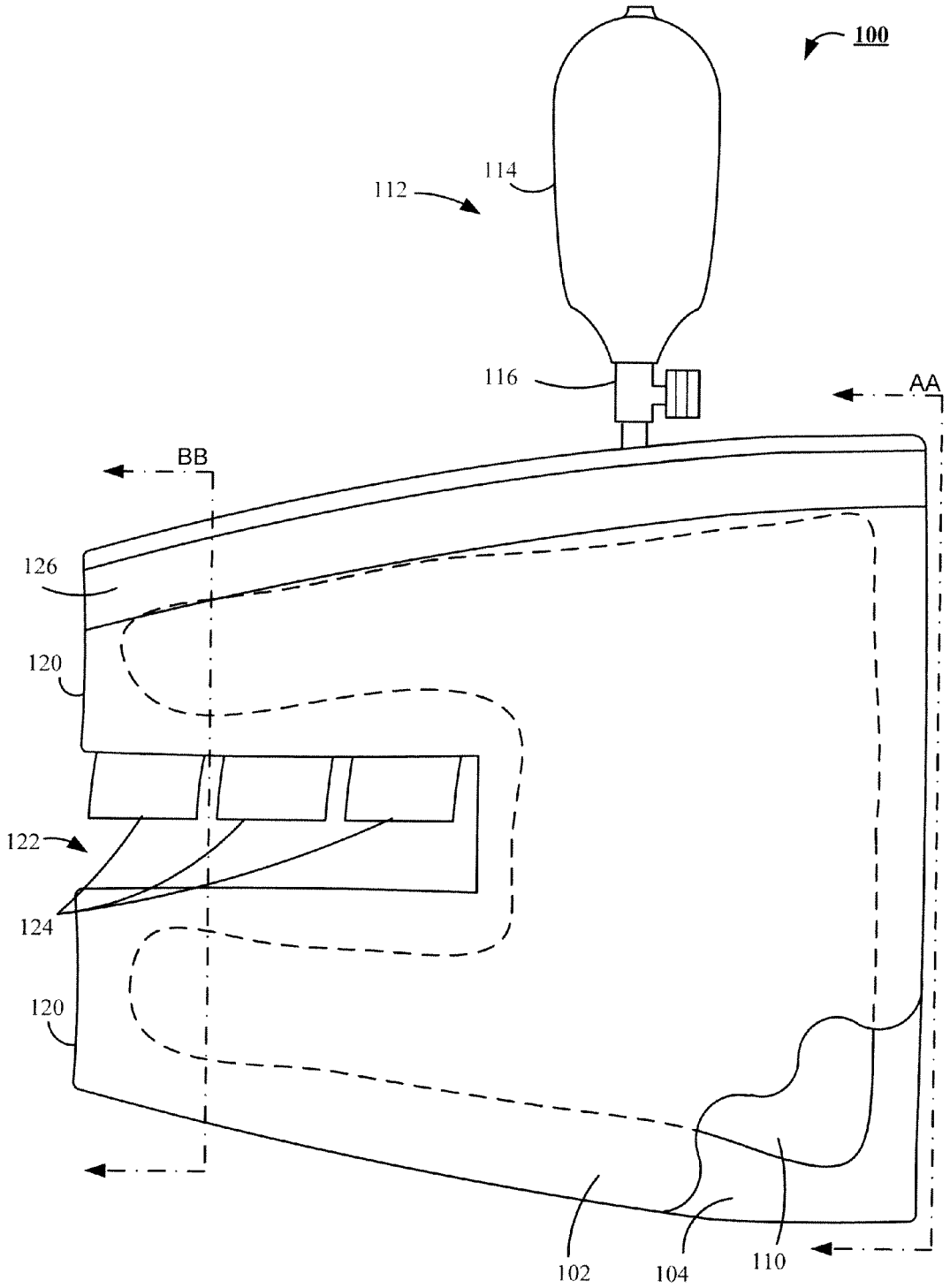
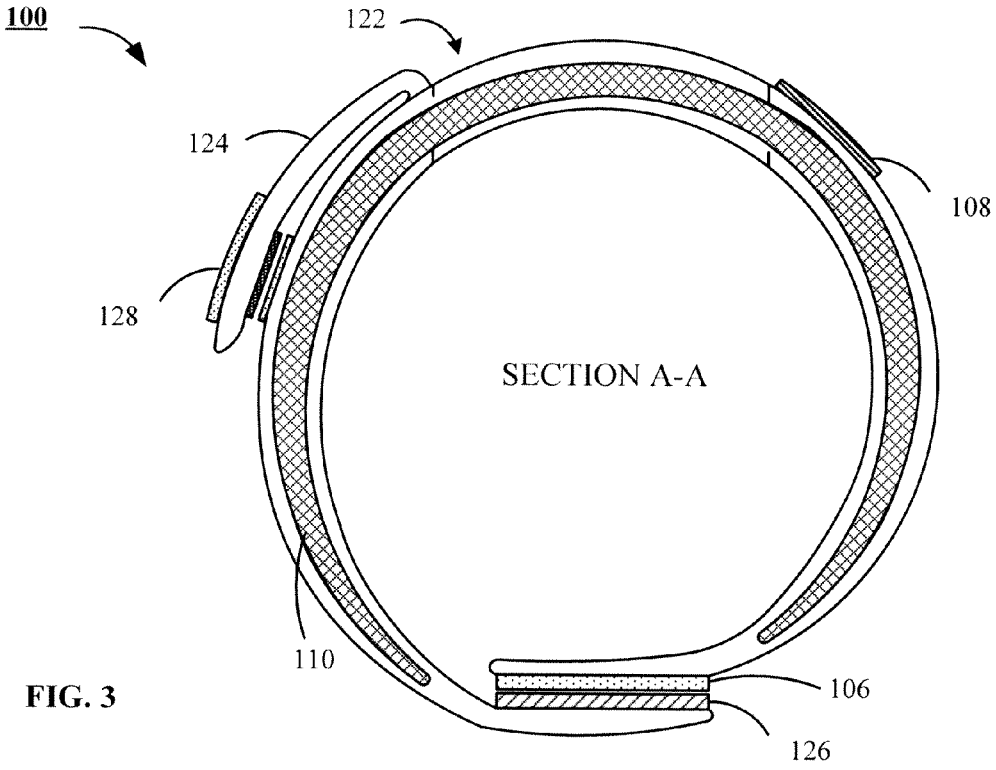


FIG. 2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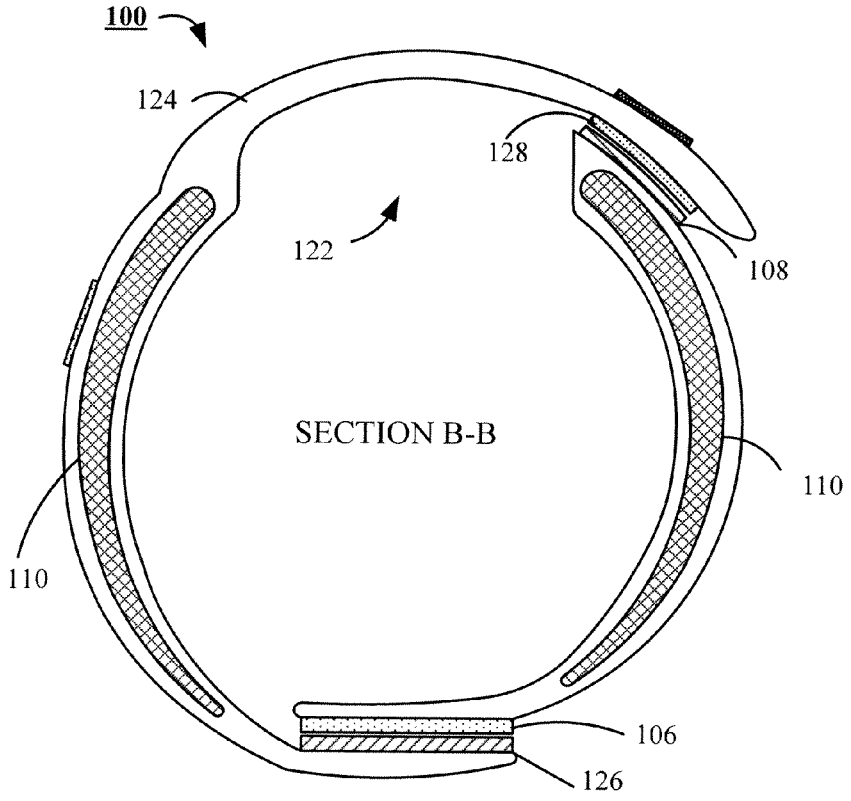
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FIG. 4

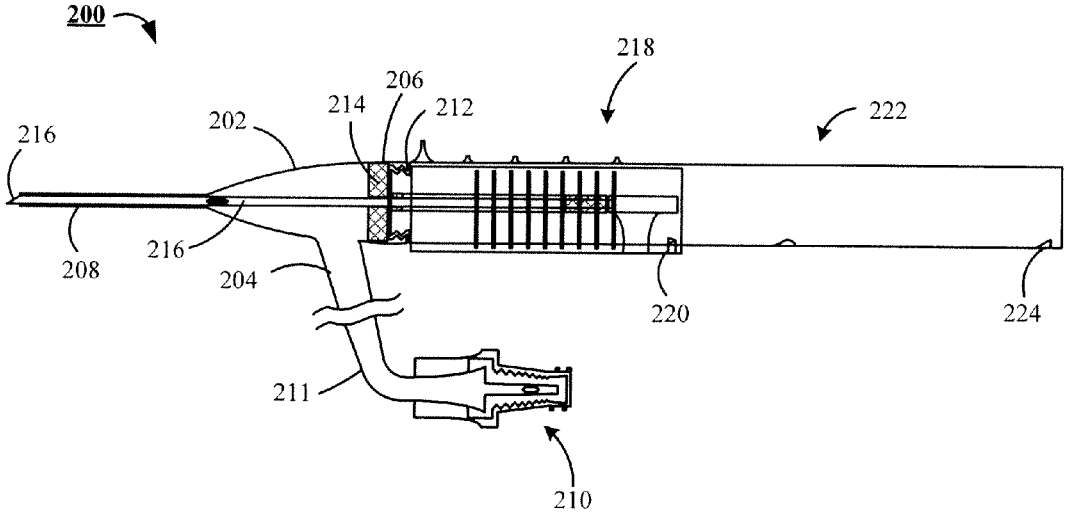
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FIG. 5

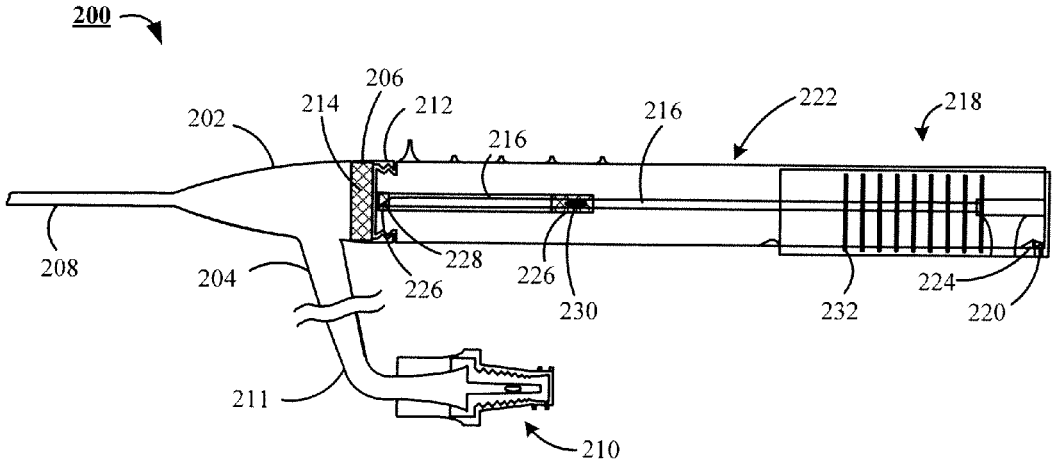
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FIG. 6

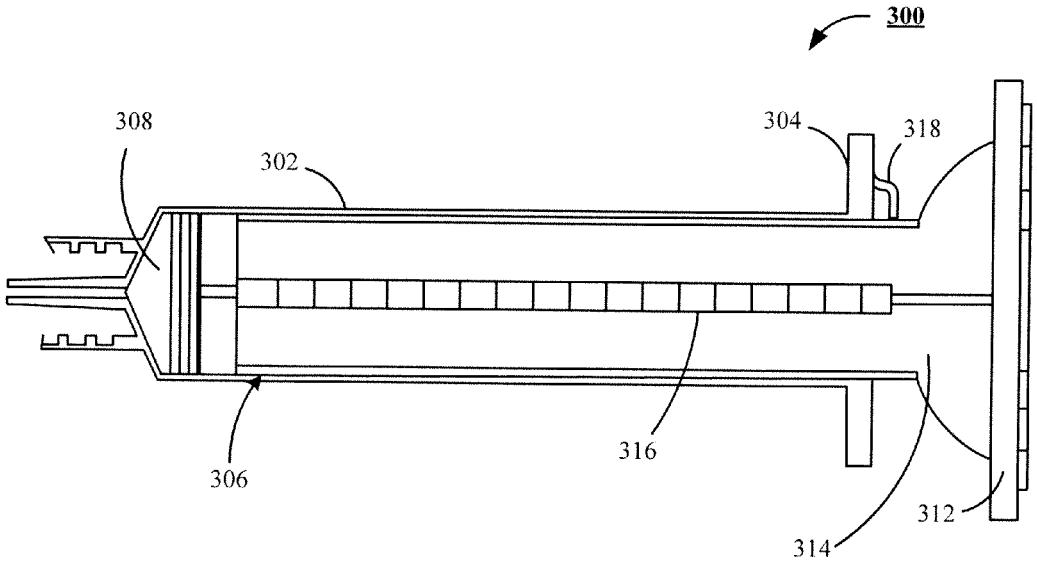
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FIG. 7

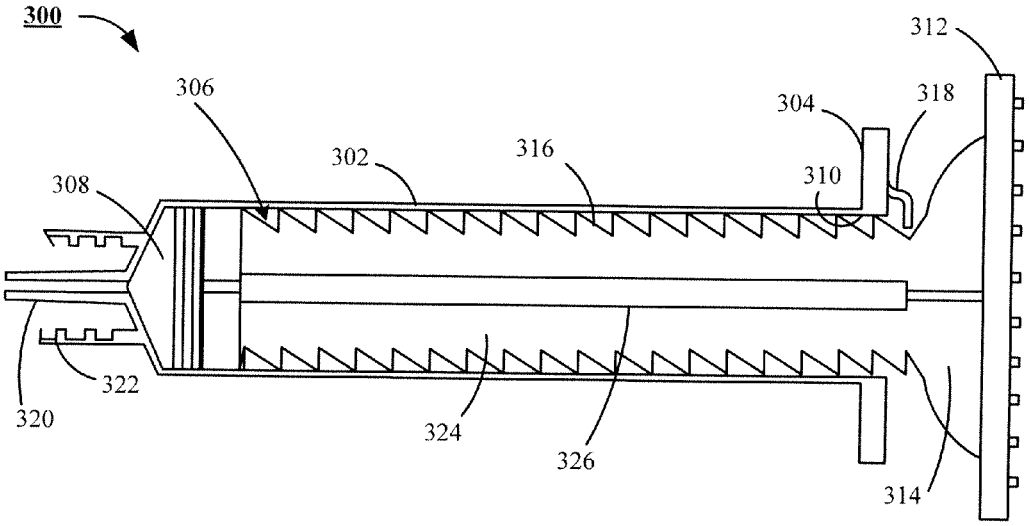
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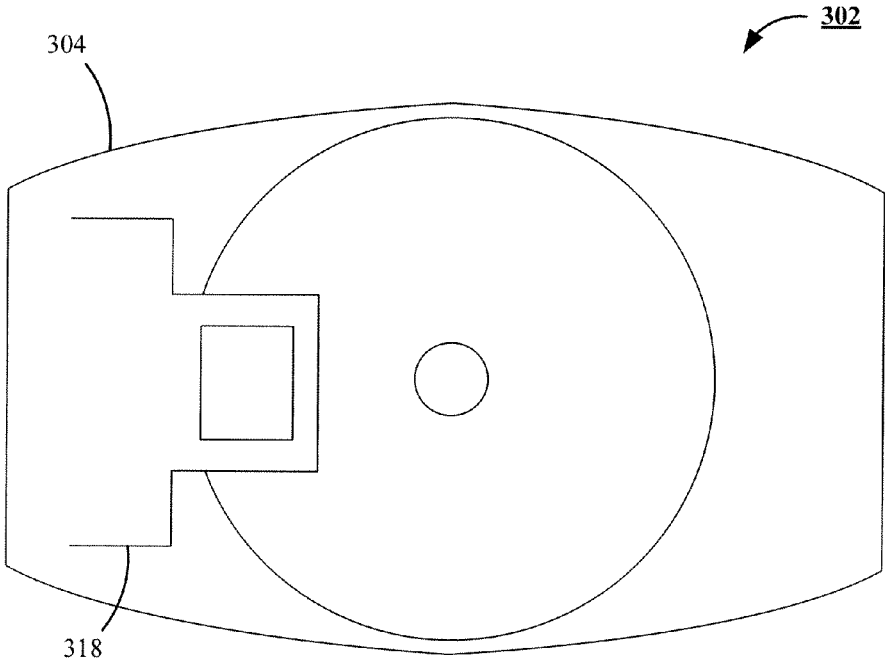
FIG. 8



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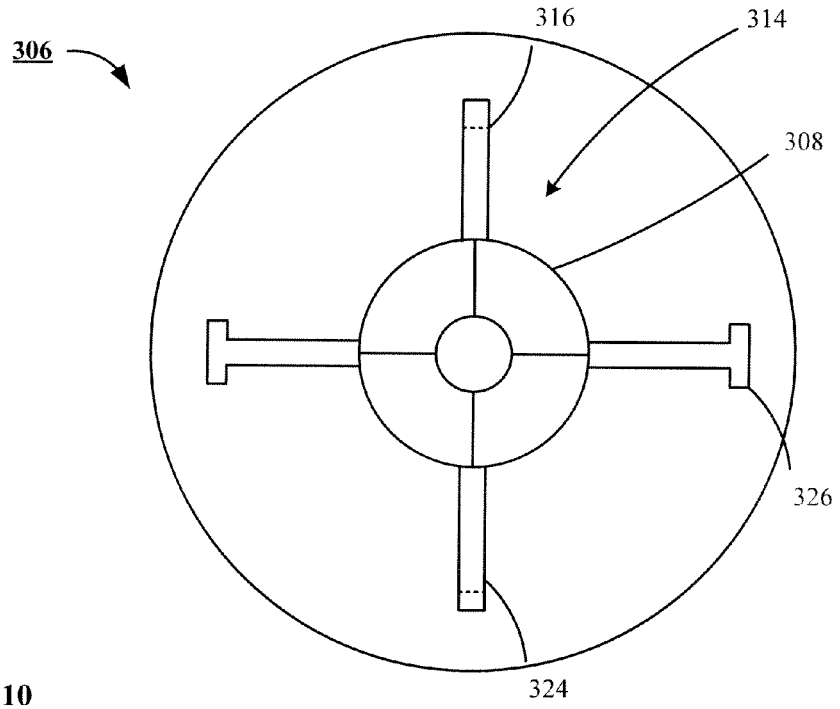

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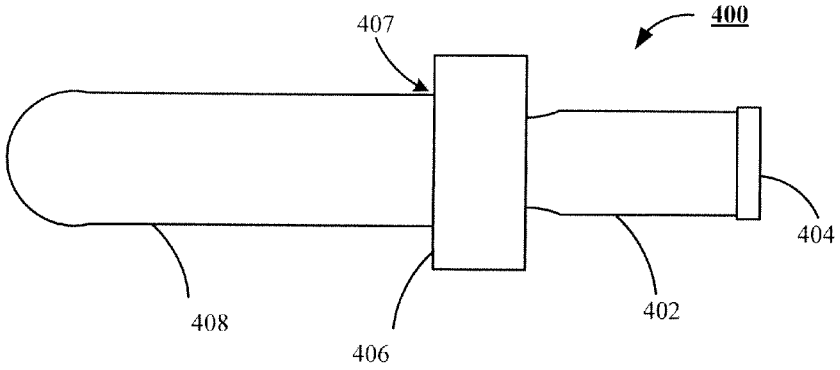

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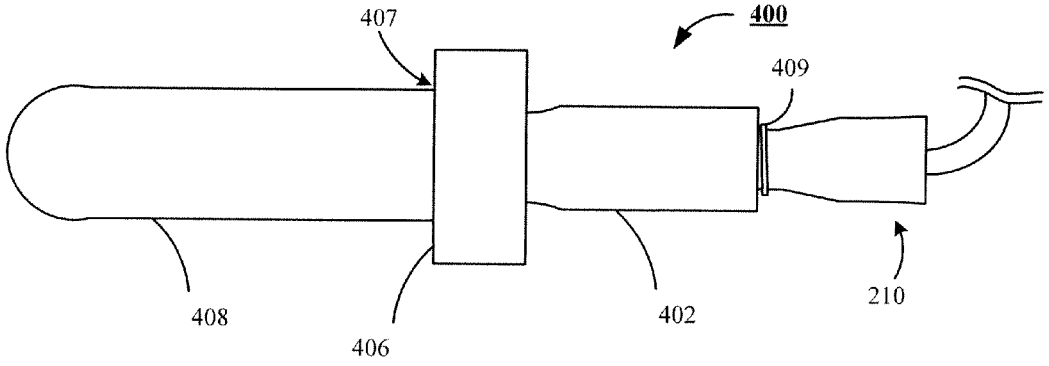
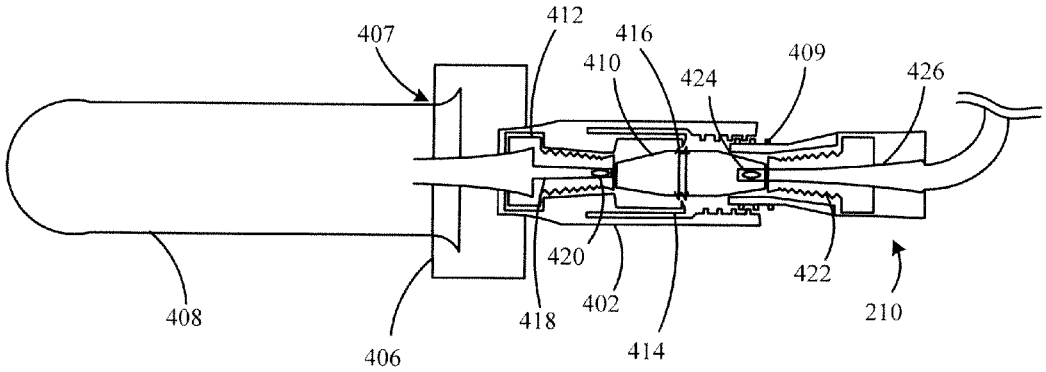


FIG. 11A



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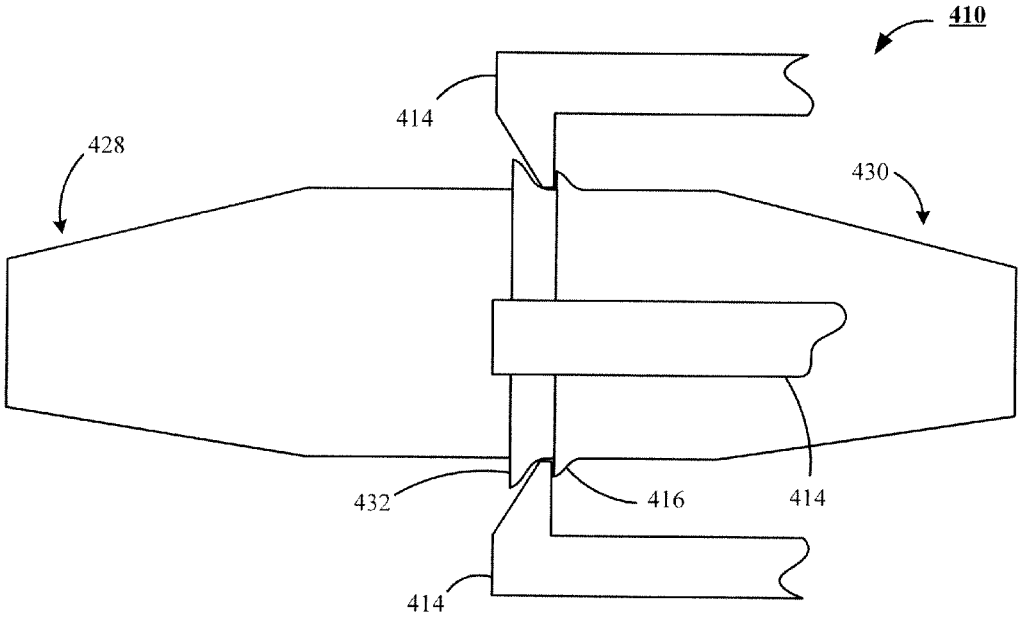

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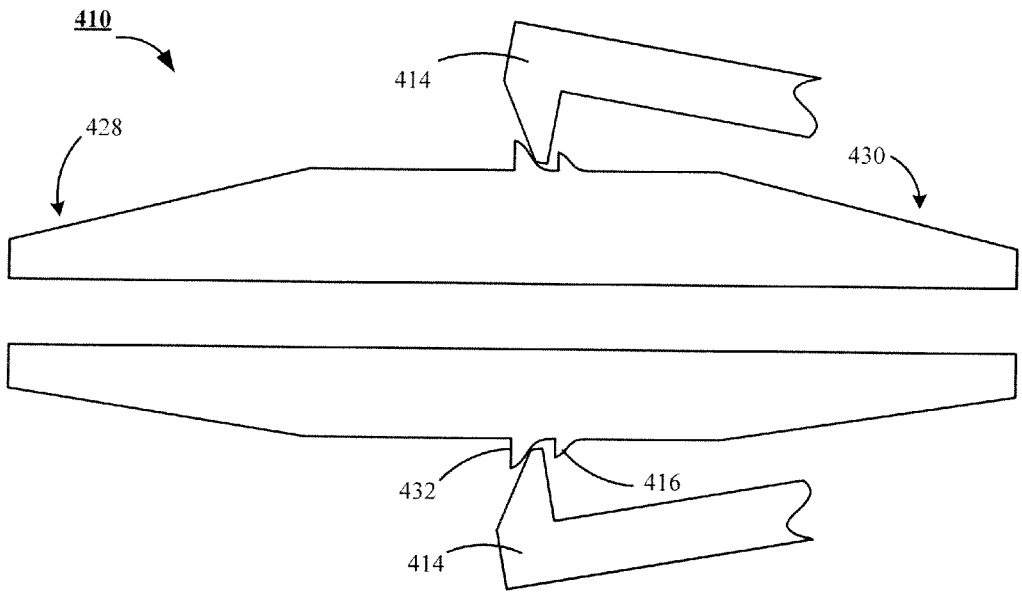

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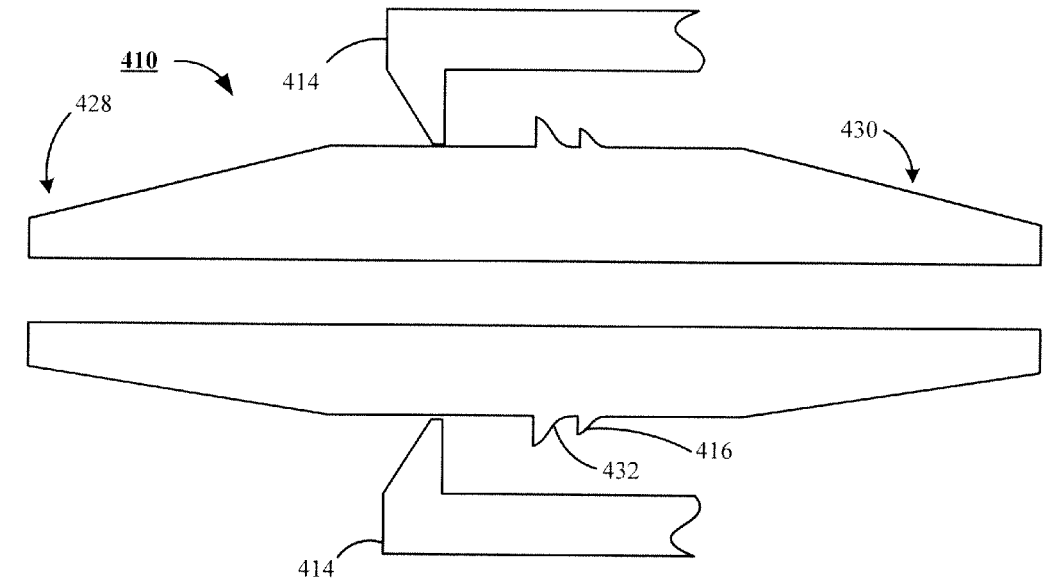

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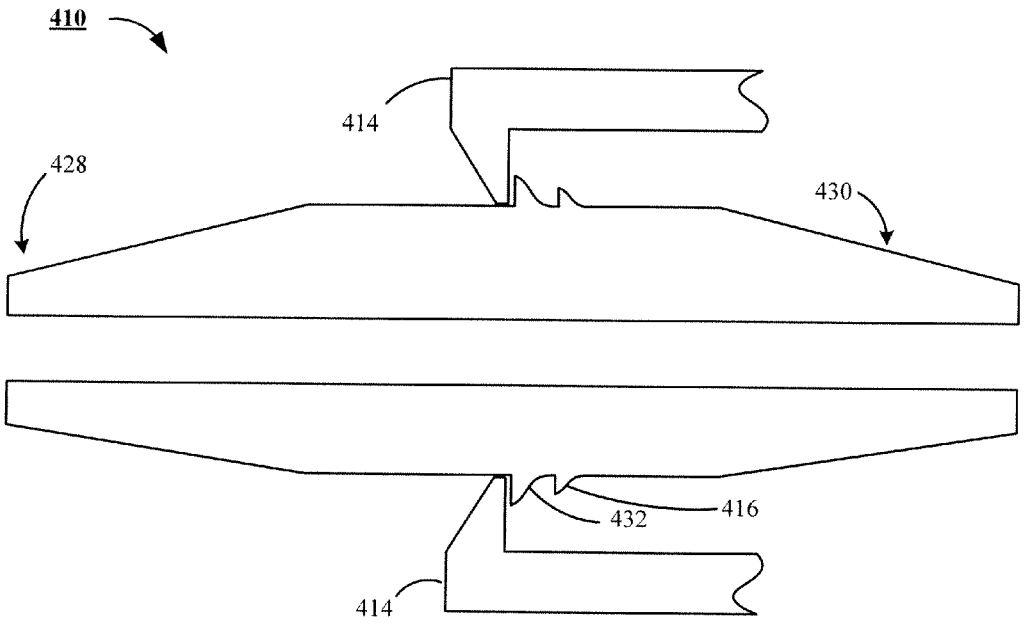

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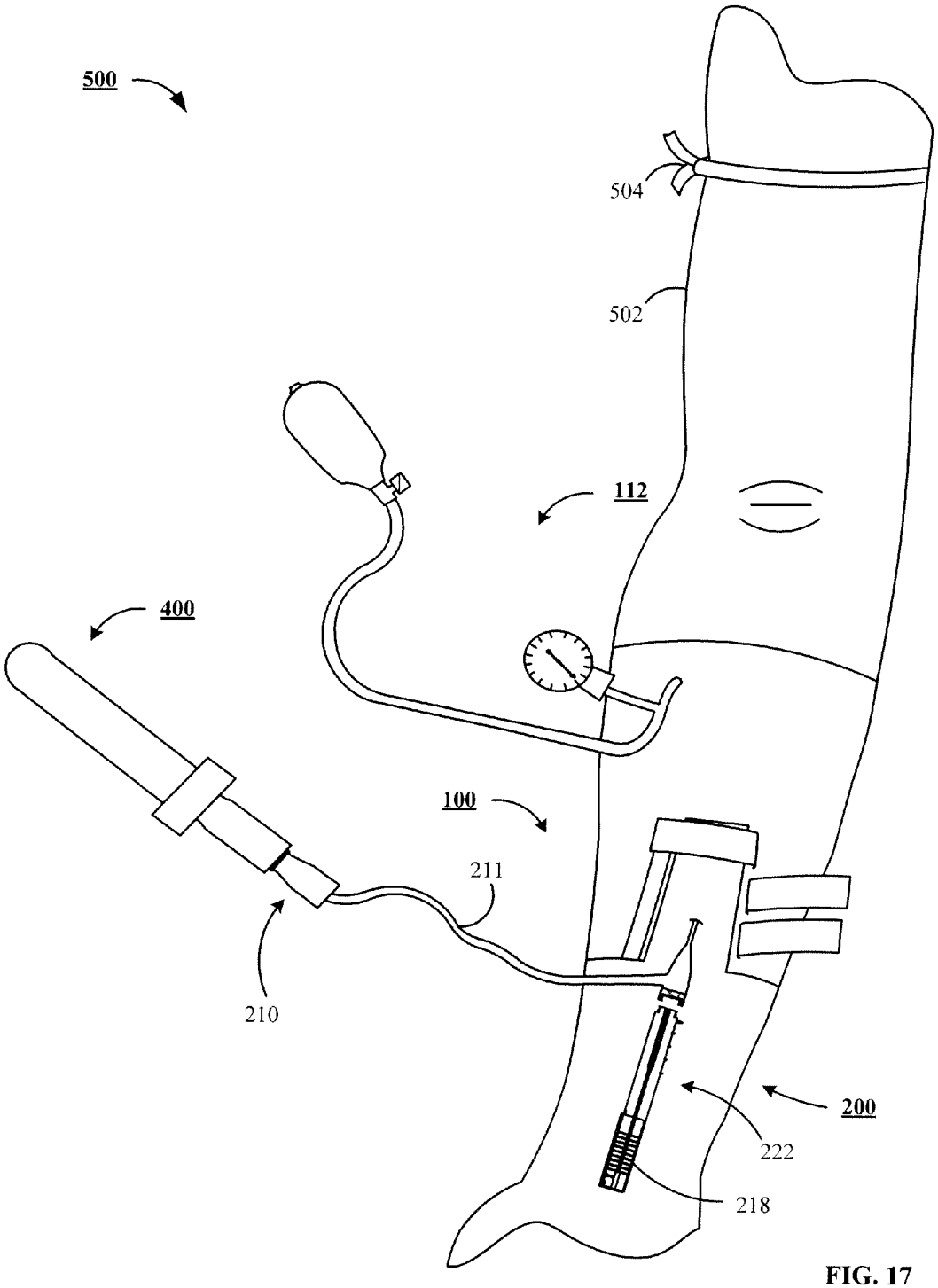
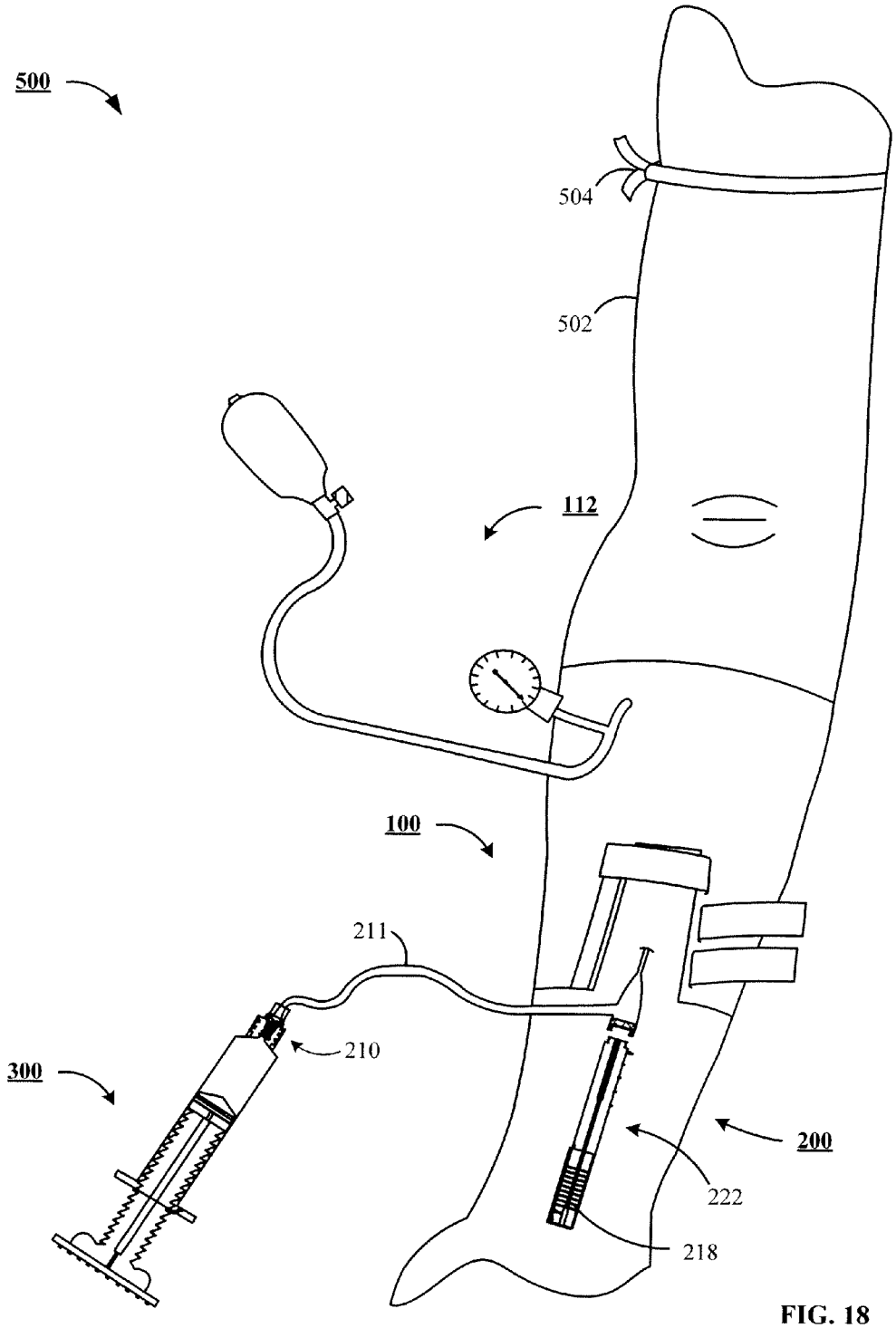


FIG. 17



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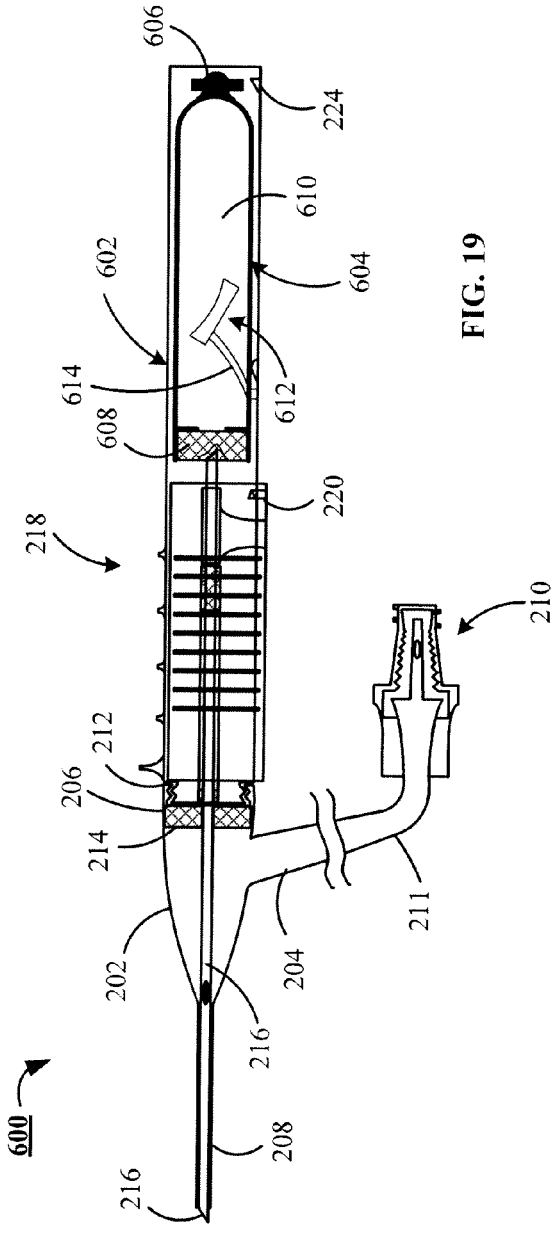
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FIG. 19

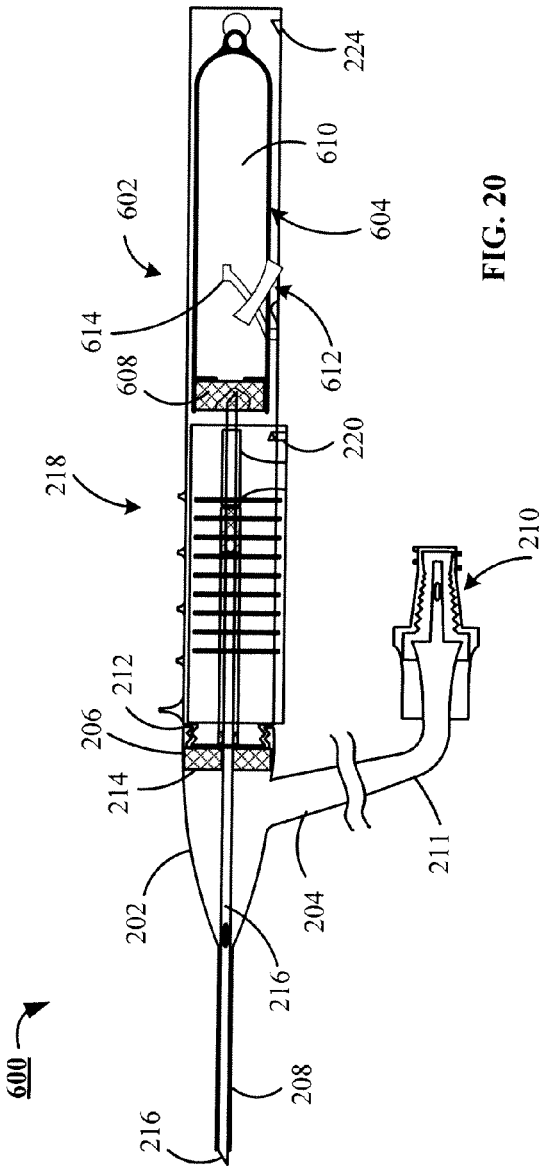
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FIG. 20

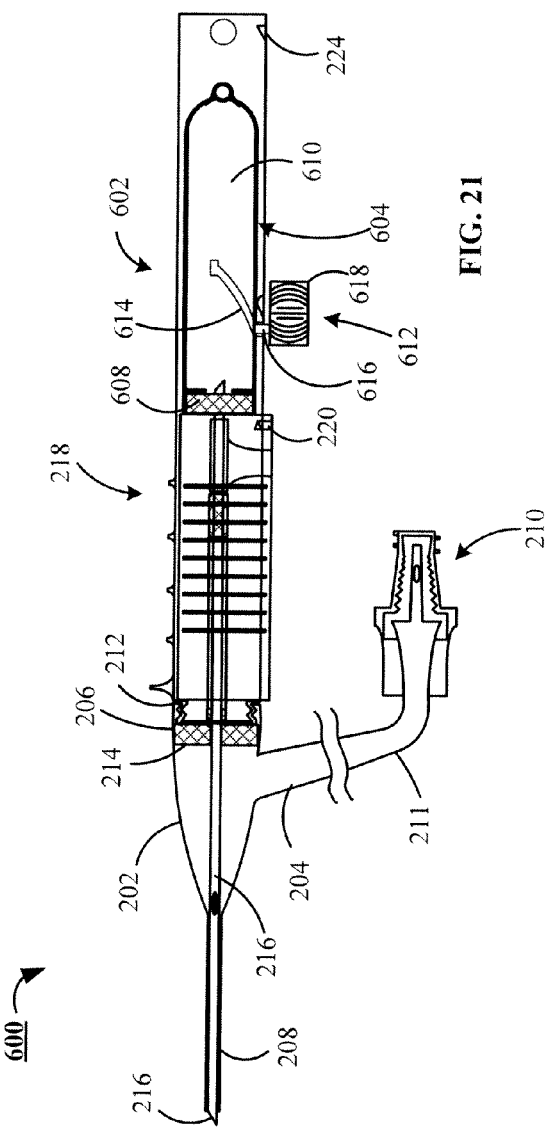
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FIG. 21

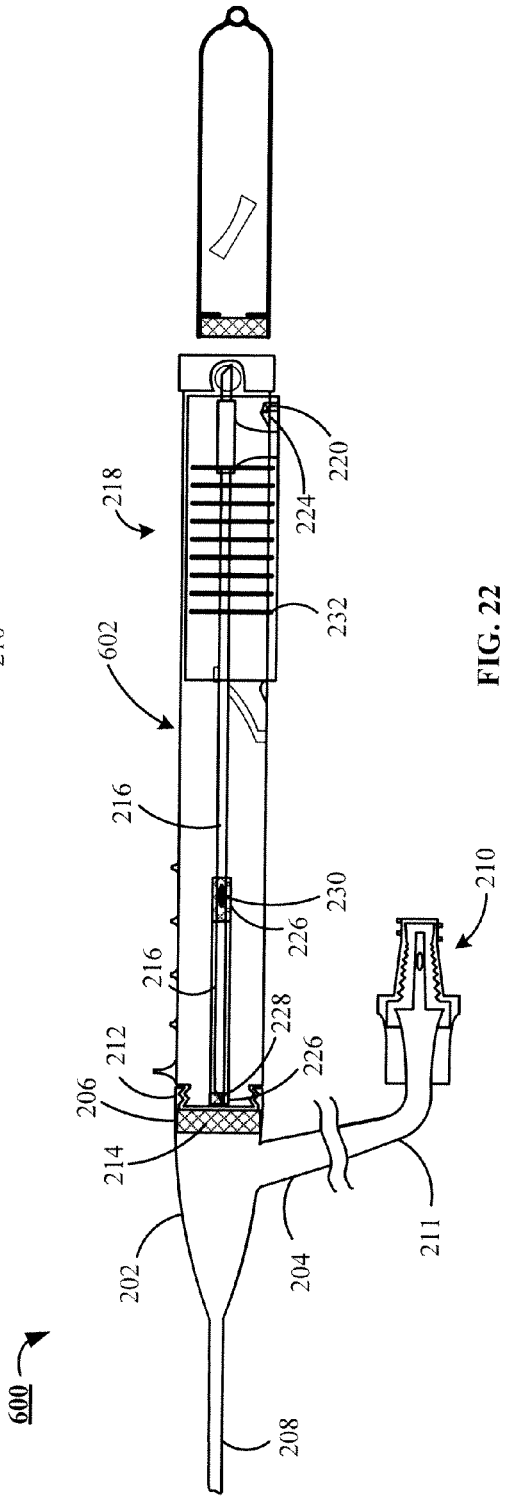
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FIG. 22

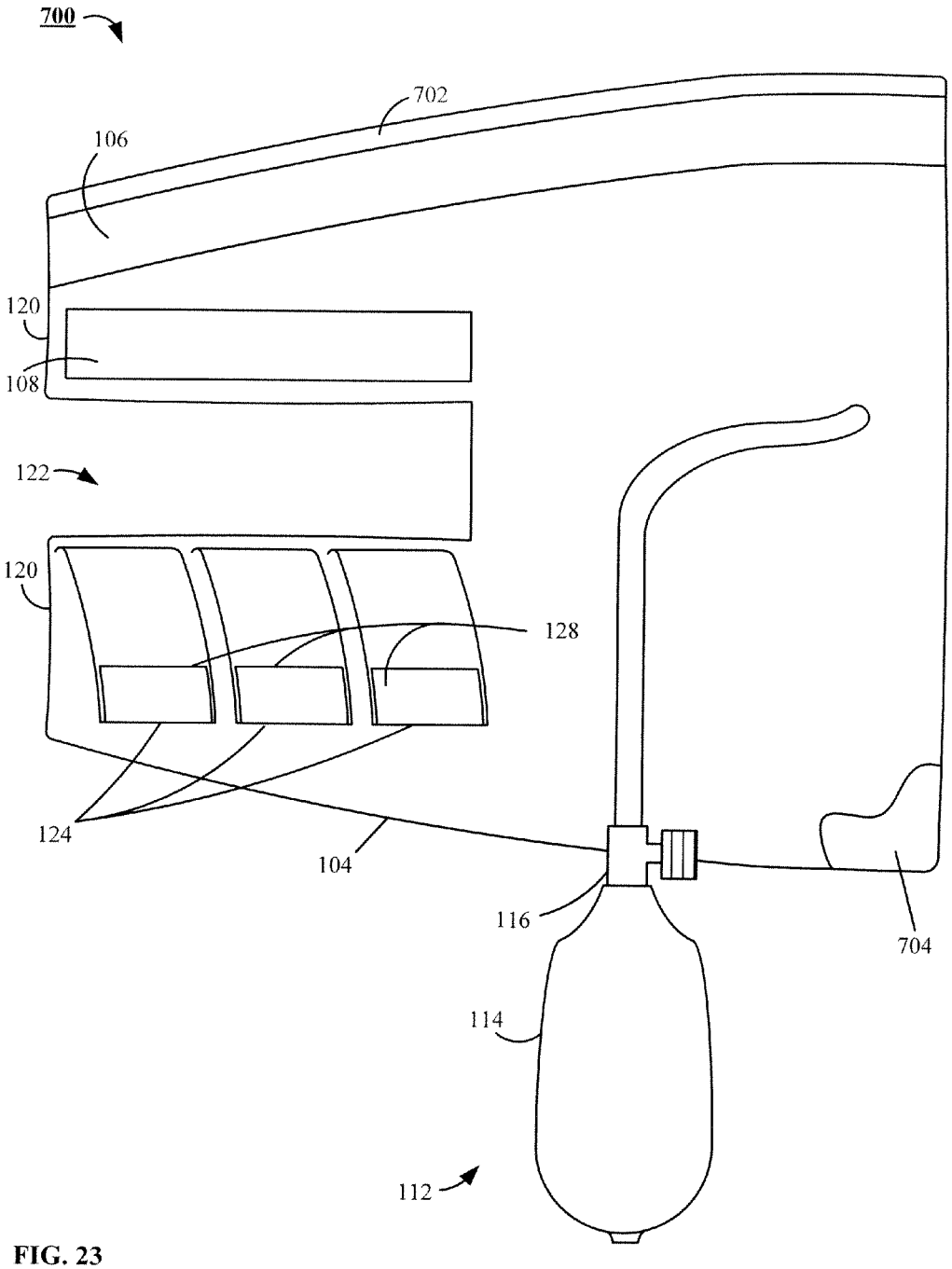
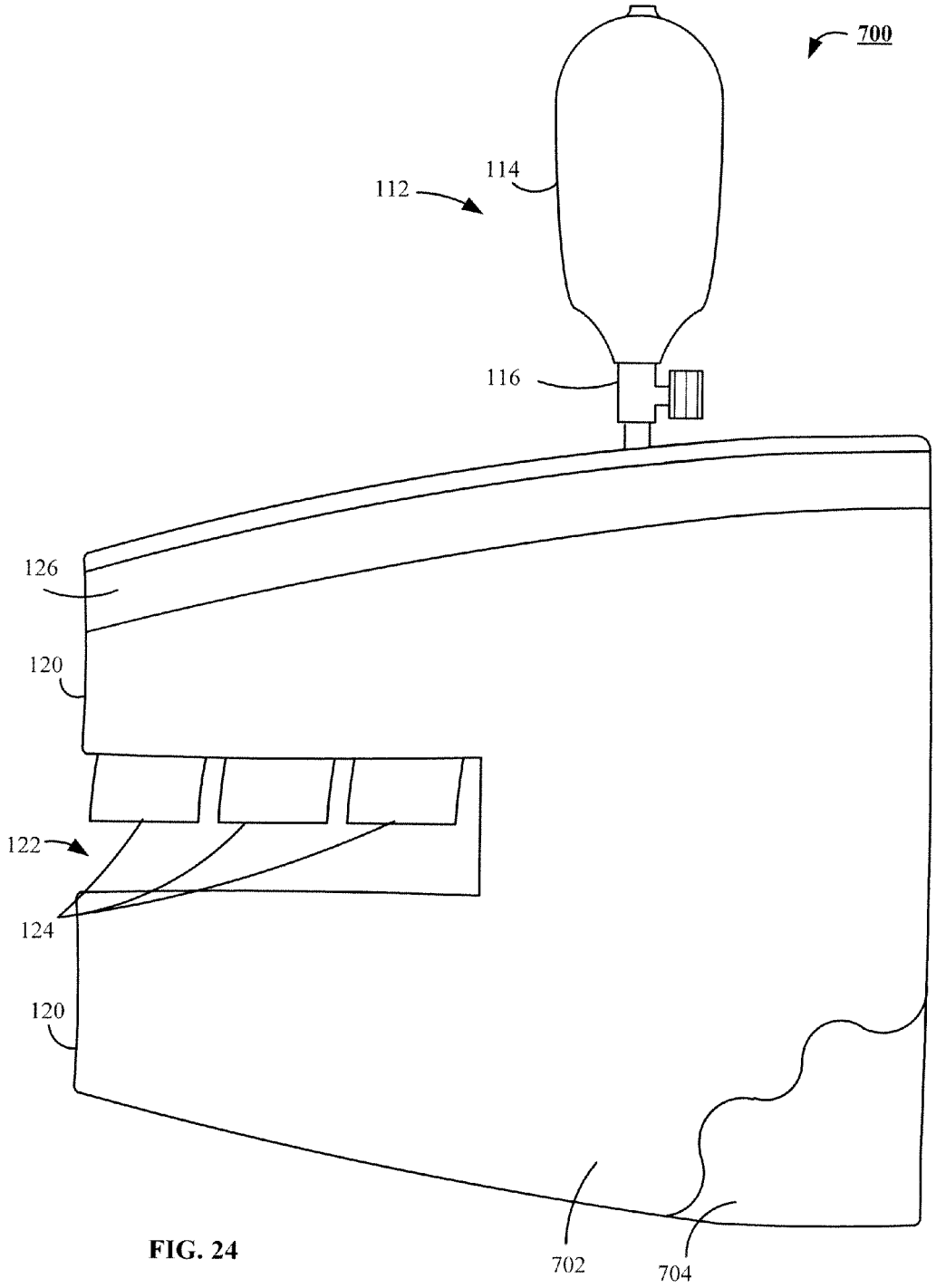


FIG. 23



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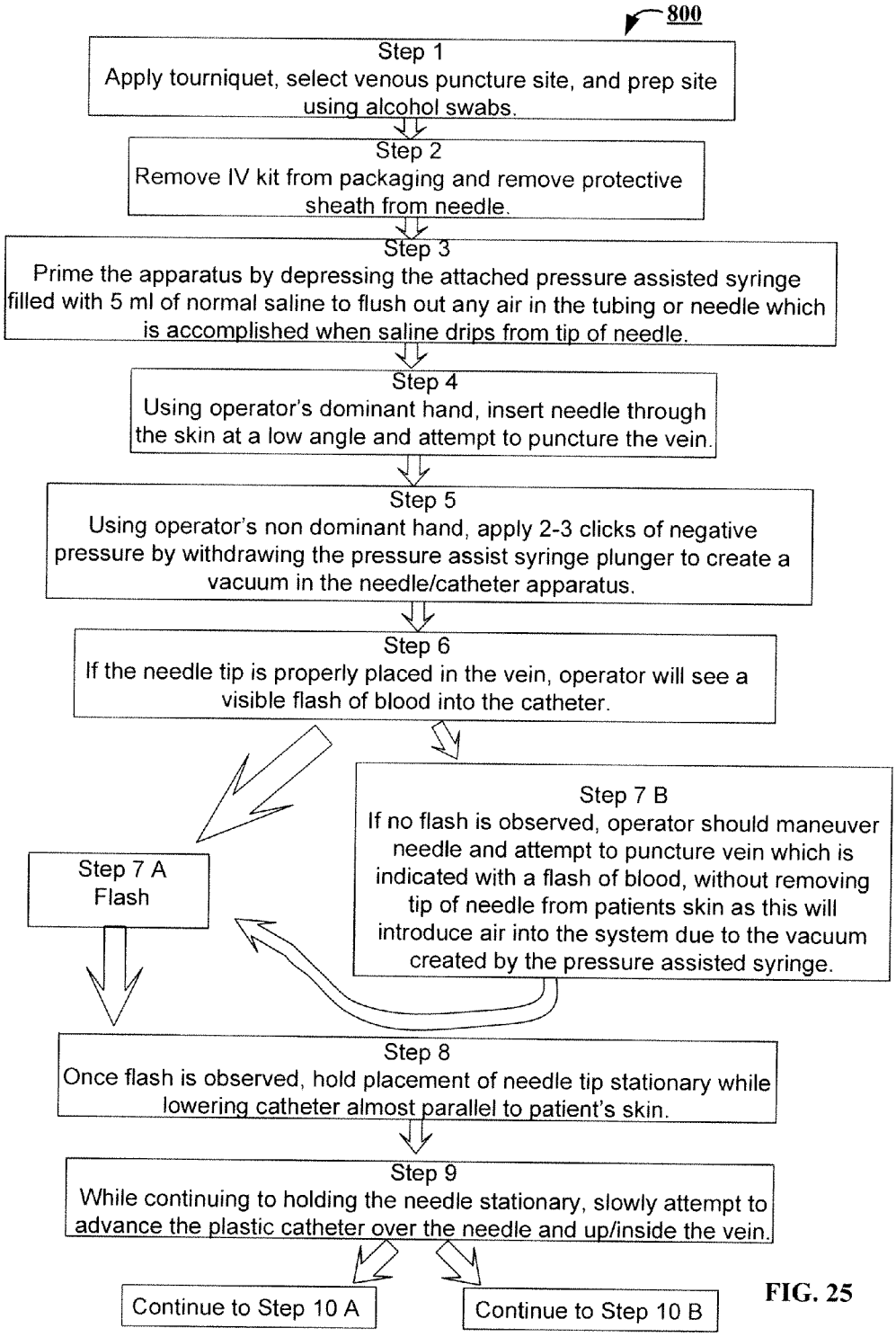
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Step 1
Apply tourniquet, select venous puncture site, and prep site using alcohol swabs.
Step 2
Remove IV kit from packaging and remove protective sheath from needle.
Step 3
Prime the apparatus by depressing the attached pressure assisted syringe filled with 5 ml of normal saline to flush out any air in the tubing or needle which is accomplished when saline drips from tip of needle.
Step 4
Using operator's dominant hand, insert needle through the skin at a low angle and attempt to puncture the vein.
Step 5
Using operator's non dominant hand, apply 2-3 clicks of negative pressure by withdrawing the pressure assist syringe plunger to create a vacuum in the needle/catheter apparatus.
Step 6
If the needle tip is properly placed in the vein, operator will see a visible flash of blood into the catheter.
Step 7 A
Flash
Step 7 B
If no flash is observed, operator should maneuver needle and attempt to puncture vein which is indicated with a flash of blood, without removing tip of needle from patients skin as this will introduce air into the system due to the vacuum created by the pressure assisted syringe.
Step 8
Once flash is observed, hold placement of needle tip stationary while lowering catheter almost parallel to patient's skin.
Step 9
While continuing to holding the needle stationary, slowly attempt to advance the plastic catheter over the needle and up/inside the vein.
Continue to Step 10 A
Continue to Step 10 B

FIG. 25

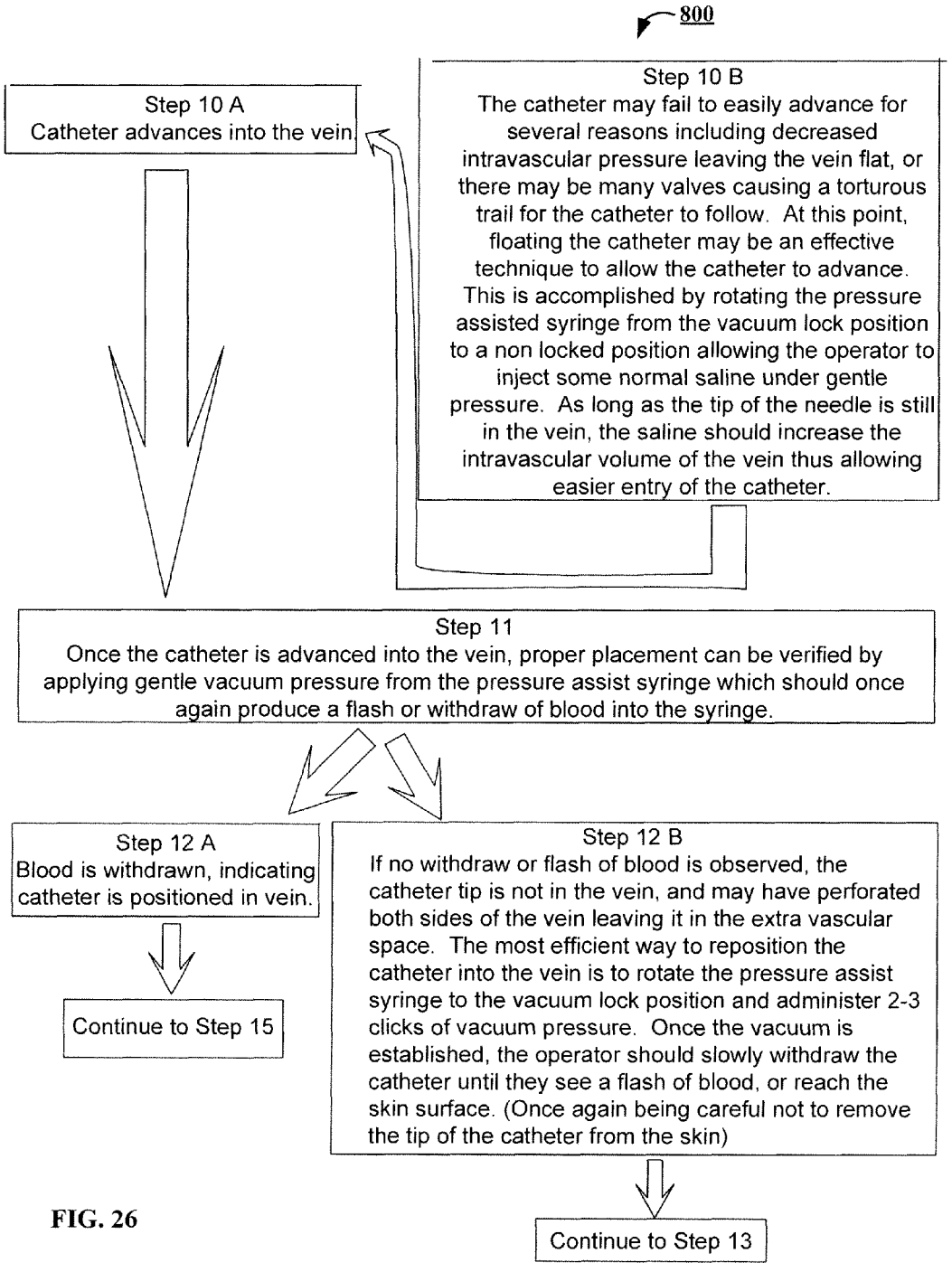

800
Step 10 A
Catheter advances into the vein.
Step 10 B
The catheter may fail to easily advance for several reasons including decreased intravascular pressure leaving the vein flat, or there may be many valves causing a torturous trail for the catheter to follow. At this point, floating the catheter may be an effective technique to allow the catheter to advance. This is accomplished by rotating the pressure assisted syringe from the vacuum lock position to a non locked position allowing the operator to inject some normal saline under gentle pressure. As long as the tip of the needle is still in the vein, the saline should increase the intravascular volume of the vein thus allowing easier entry of the catheter.
Step 11
Once the catheter is advanced into the vein, proper placement can be verified by applying gentle vacuum pressure from the pressure assist syringe which should once again produce a flash or withdraw of blood into the syringe.
Step 12 A
Blood is withdrawn, indicating catheter is positioned in vein.
Continue to Step 15
Step 12 B
If no withdraw or flash of blood is observed, the catheter tip is not in the vein, and may have perforated both sides of the vein leaving it in the extra vascular space. The most efficient way to reposition the catheter into the vein is to rotate the pressure assist syringe to the vacuum lock position and administer 2-3 clicks of vacuum pressure. Once the vacuum is established, the operator should slowly withdraw the catheter until they see a flash of blood, or reach the skin surface. (Once again being careful not to remove the tip of the catheter from the skin)
Continue to Step 13

FIG. 26

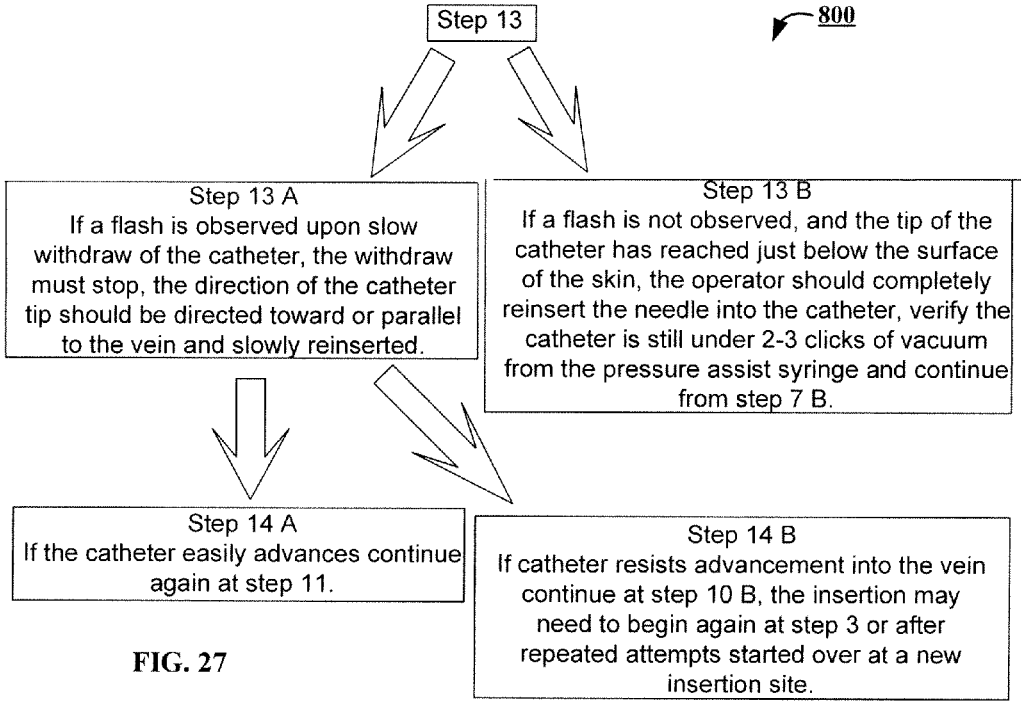

800
Step 13
Step 13 A
If a flash is observed upon slow withdraw of the catheter, the withdraw must stop, the direction of the catheter tip should be directed toward or parallel to the vein and slowly reinserted.
Step 13 B
If a flash is not observed, and the tip of the catheter has reached just below the surface of the skin, the operator should completely reinsert the needle into the catheter, verify the catheter is still under 2-3 clicks of vacuum from the pressure assist syringe and continue from step 7 B.
Step 14 A
If the catheter easily advances continue again at step 11.
Step 14 B
If catheter resists advancement into the vein continue at step 10 B, the insertion may need to begin again at step 3 or after repeated attempts started over at a new insertion site.

FIG. 27

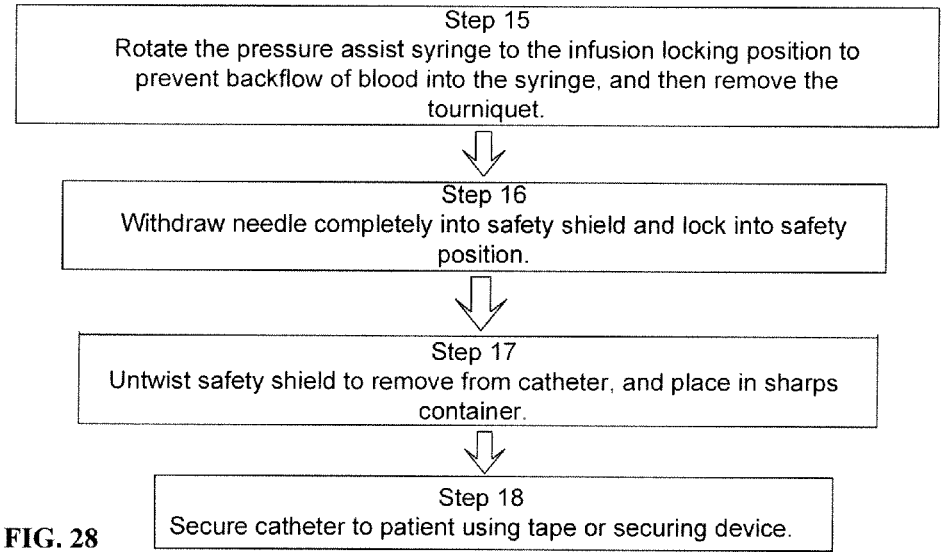

Step 15
Rotate the pressure assist syringe to the infusion locking position to prevent backflow of blood into the syringe, and then remove the tourniquet.
Step 16
Withdraw needle completely into safety shield and lock into safety position.
Step 17
Untwist safety shield to remove from catheter, and place in sharps container.
Step 18
Secure catheter to patient using tape or securing device.

FIG. 28

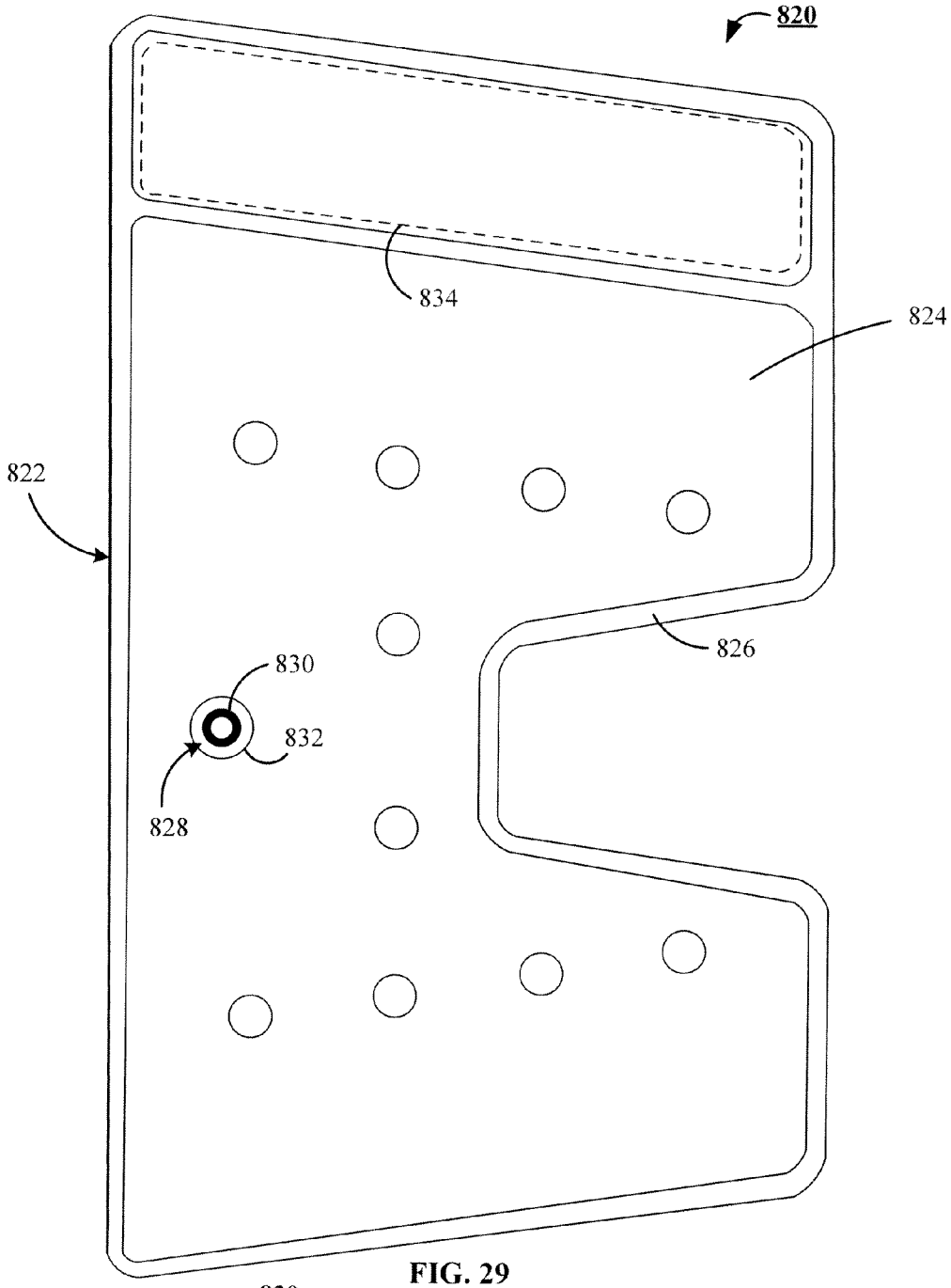


FIG. 29

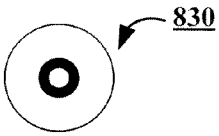


FIG. 30

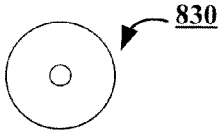


FIG. 31

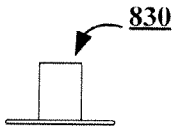


FIG. 32

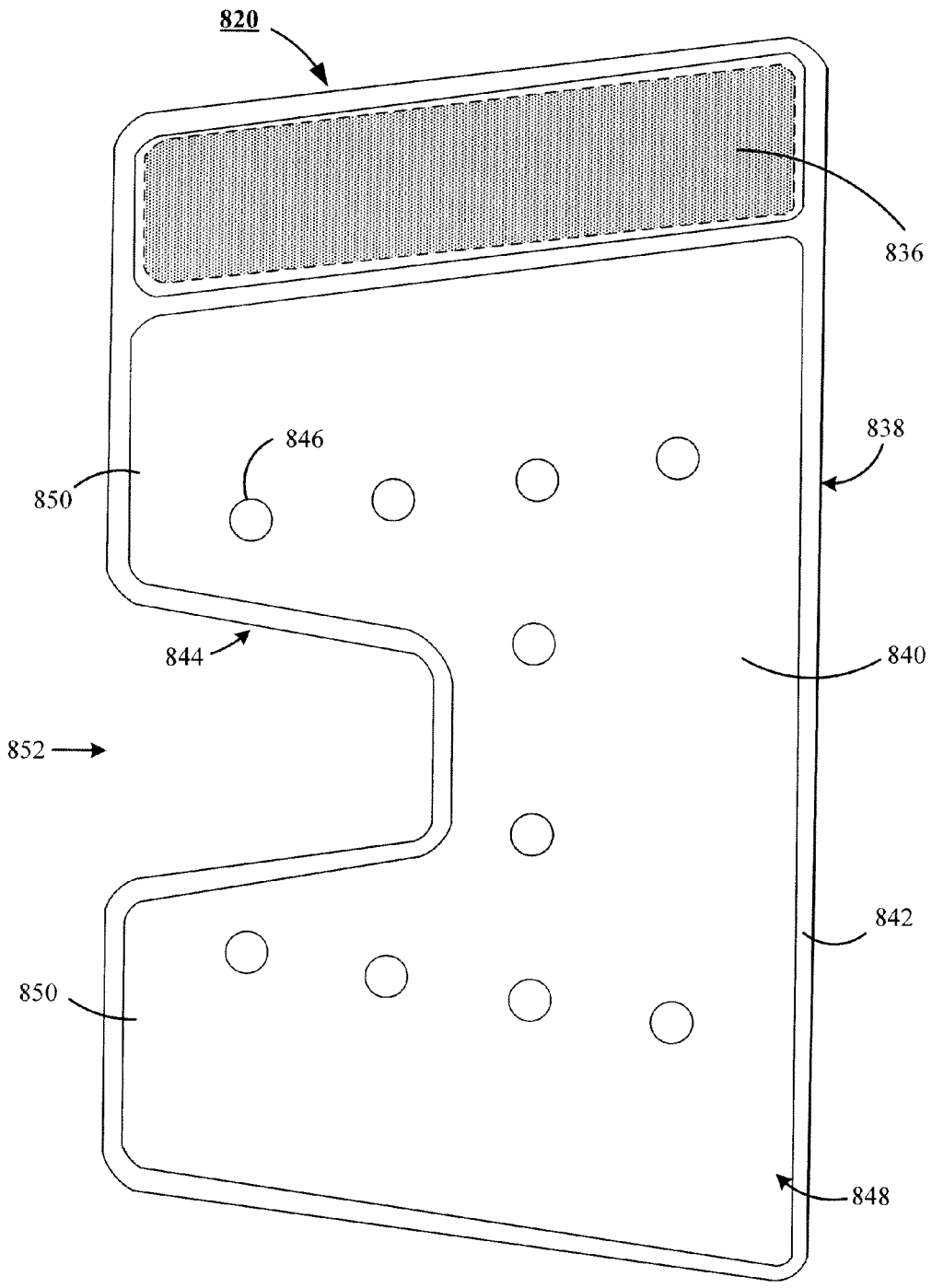


FIG. 33

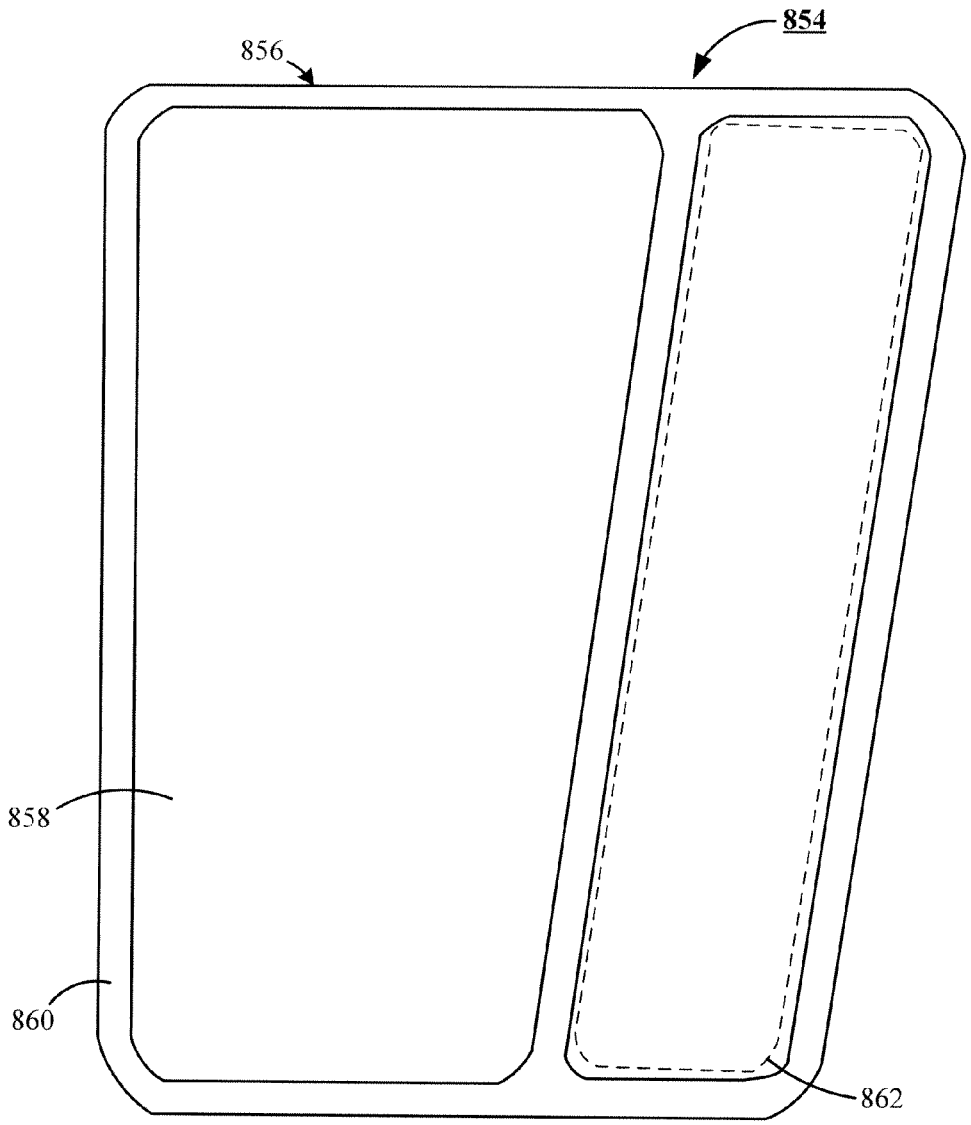


FIG. 34

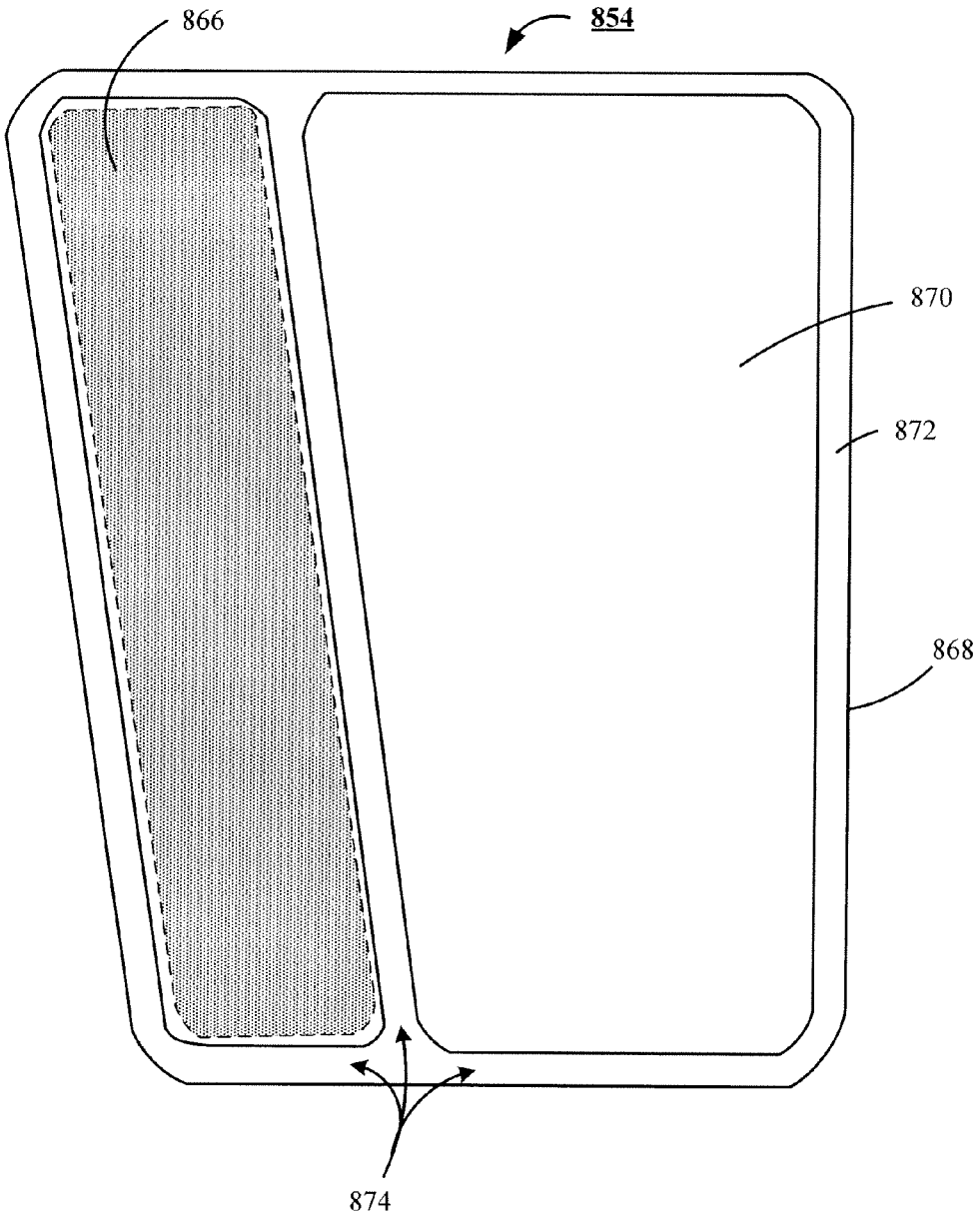


FIG. 35

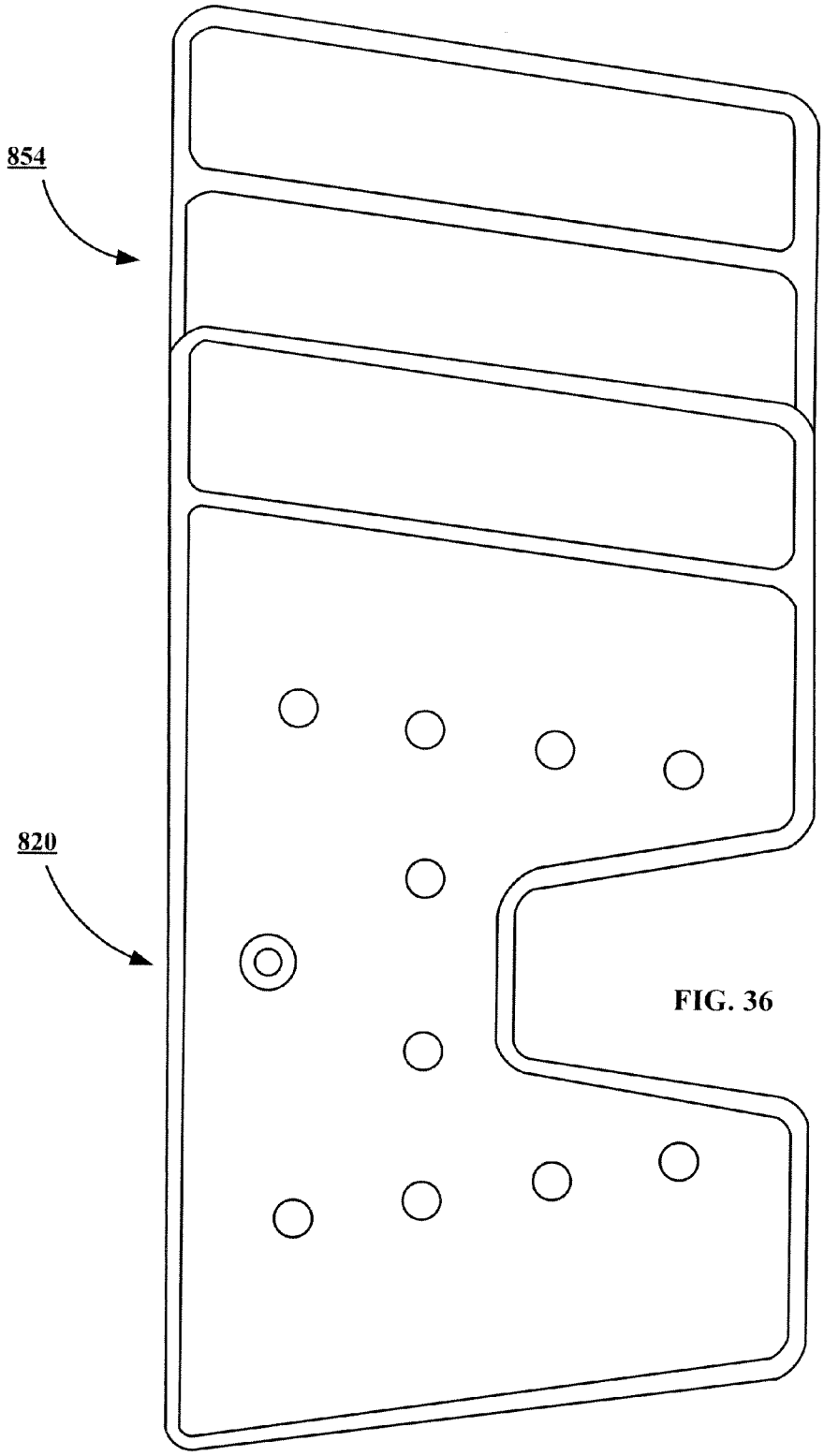


FIG. 36

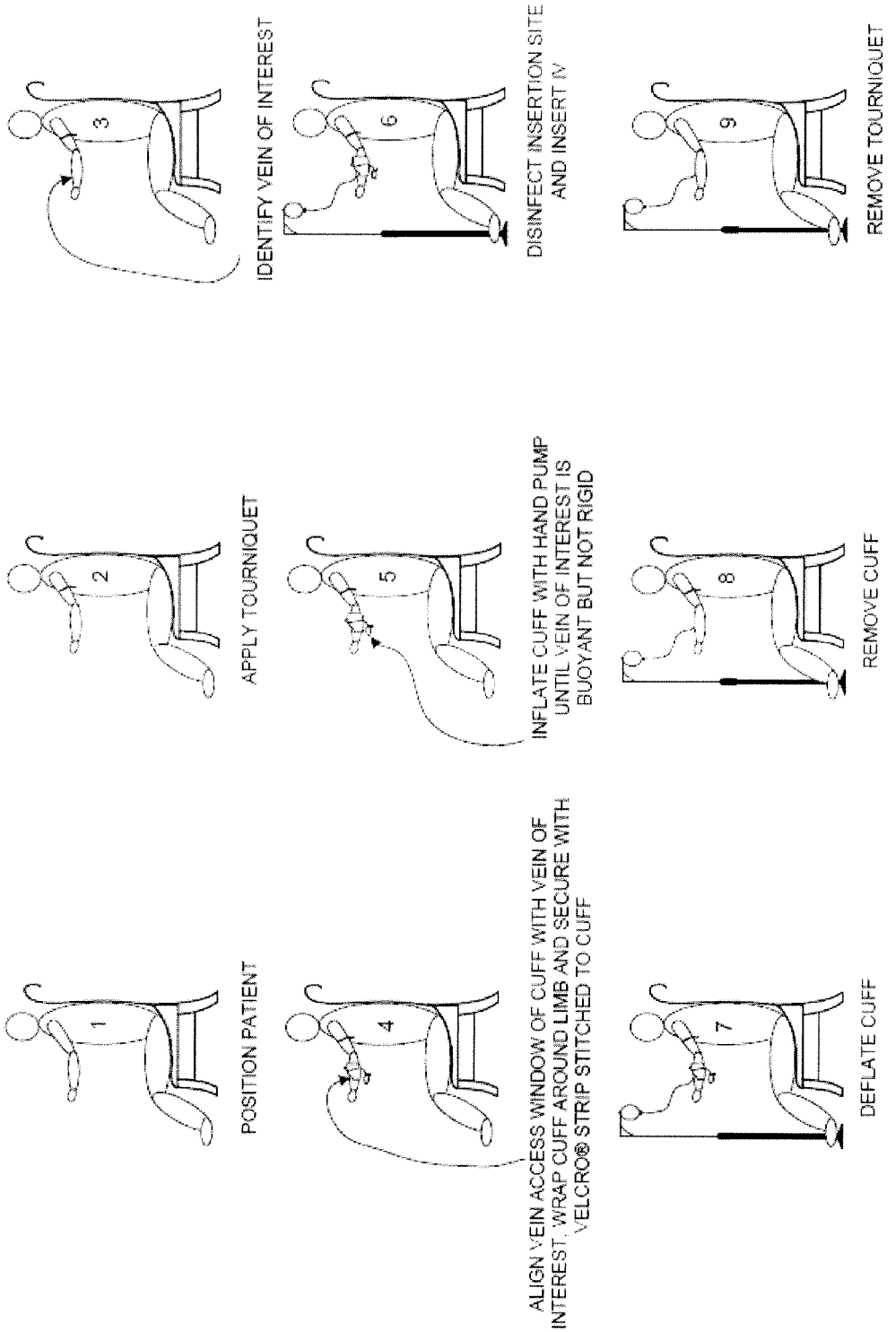

1
POSITION PATIENT
2
APPLY TOURNIQUET
3
IDENTIFY VEIN OF INTEREST
4
ALIGN VEIN ACCESS WINDOW OF CUFF WITH VEIN OF INTEREST. WRAP CUFF AROUND LIMB AND SECURE WITH VELCRO® STRIP STITCHED TO CUFF
5
INFLATE CUFF WITH HAND PUMP UNTIL VEIN OF INTEREST IS BUOYANT BUT NOT RIGID
6
DISINFECT INSERTION SITE AND INSERT IV
7
DEFLATE CUFF
8
REMOVE CUFF
9
REMOVE TOURNIQUET

FIG. 37

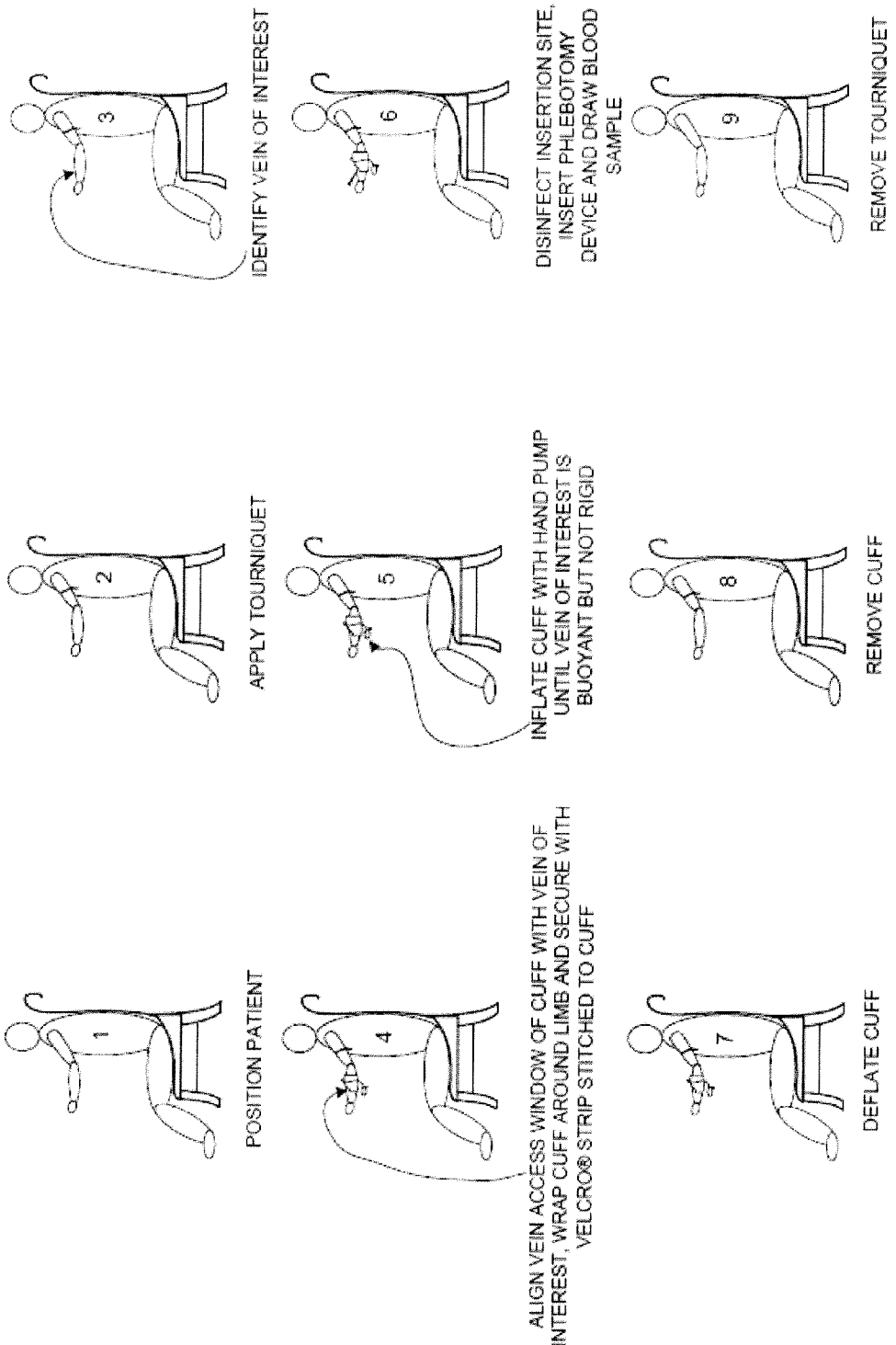
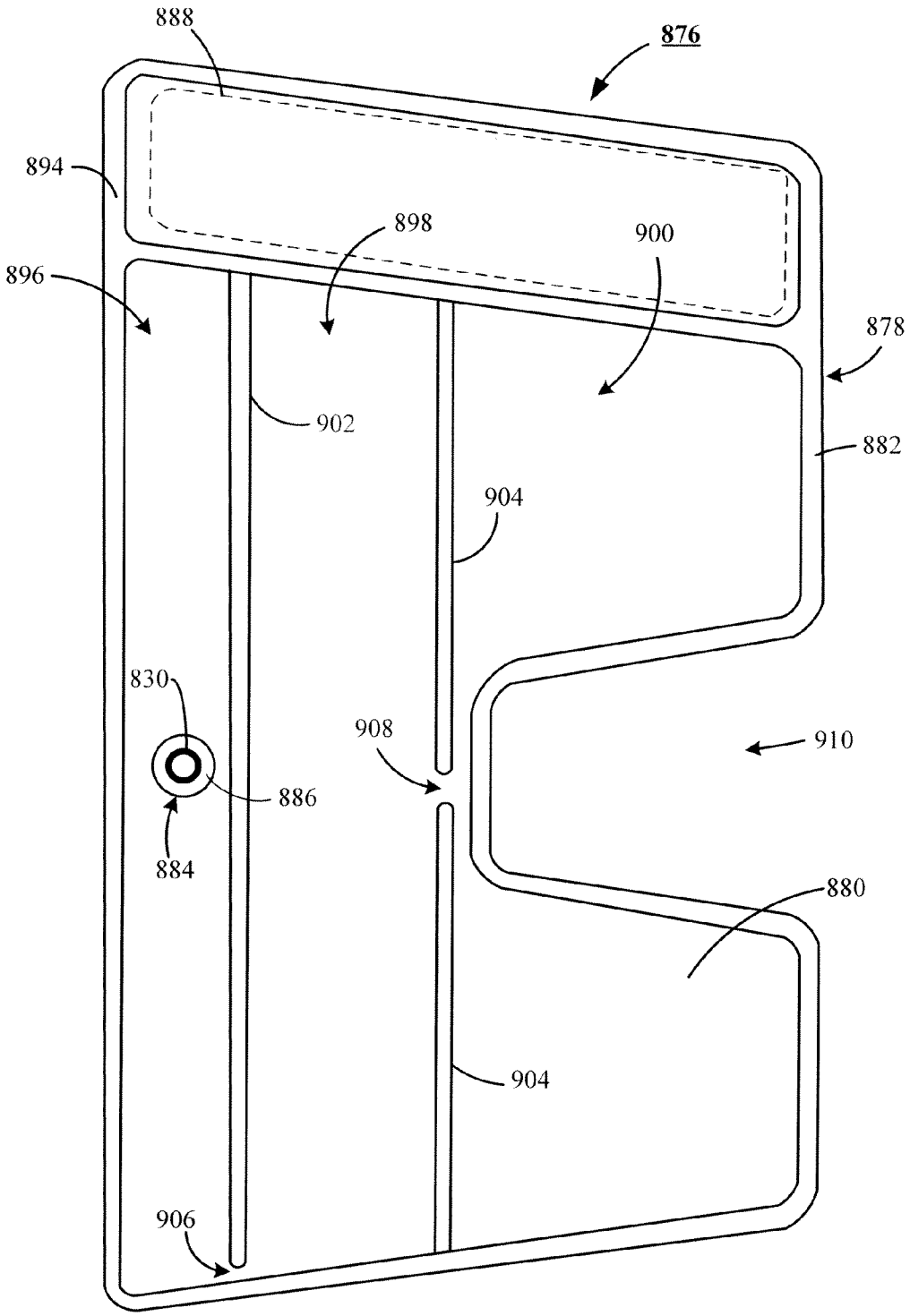

1
POSITION PATIENT
2
APPLY TOURNIQUET
3
IDENTIFY VEIN OF INTEREST
4
ALIGN VEIN ACCESS WINDOW OF CUFF WITH VEIN OF INTEREST, WRAP CUFF AROUND LIMB AND SECURE WITH VELCRO® STRIP STITCHED TO CUFF
5
INFLATE CUFF WITH HAND PUMP UNTIL VEIN OF INTEREST IS BUOYANT BUT NOT RIGID
6
DISINFECT INSERTION SITE, INSERT PHLEBOTOMY DEVICE AND DRAW BLOOD SAMPLE
7
DEFLATE CUFF
8
REMOVE CUFF
9
REMOVE TOURNIQUET

FIG. 38


888
876
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878
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904
830
908
910
886
884
880
904
906

FIG. 39

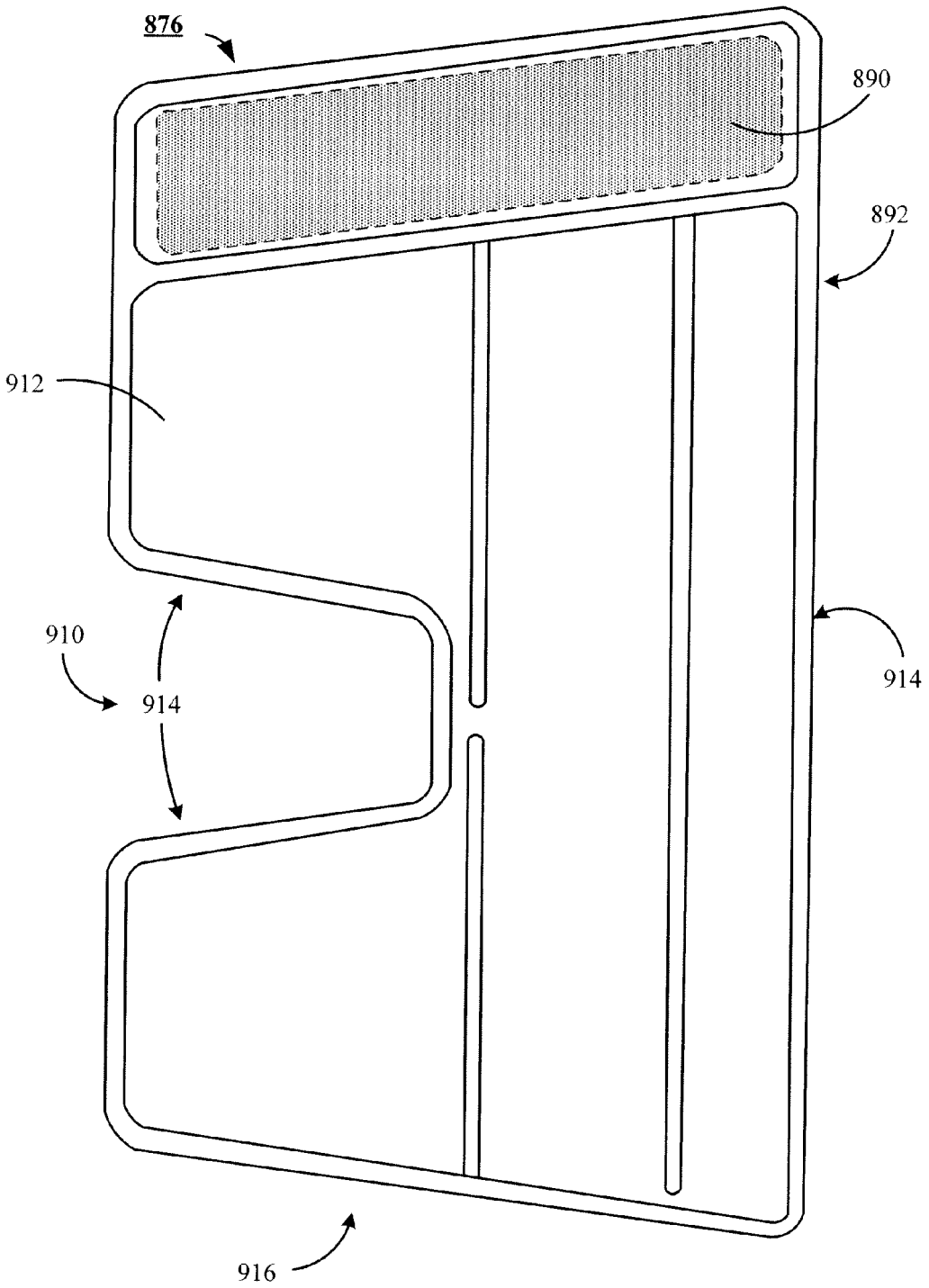

FIG. 40

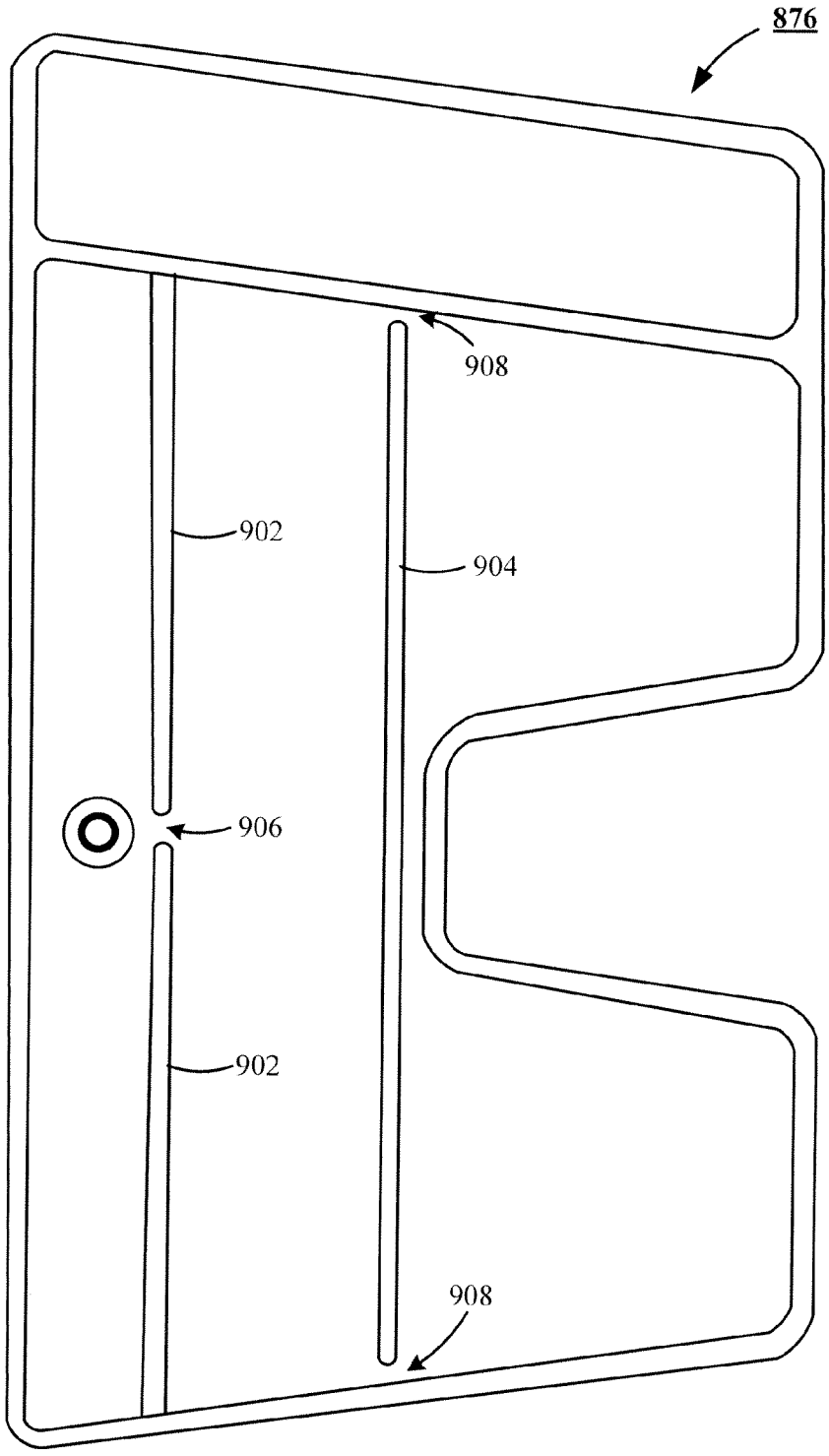

FIG. 41

VEIN PRESENTATION ENHANCEMENT DEVICE

RELATED APPLICATIONS

This application is a continuation-in-part to U.S. patent application Ser. No. 12/470,404 filed May 21, 2009, which claims priority to Provisional Patent Application Ser. No. 61/054,961 filed May 21, 2008.

FIELD OF THE INVENTION

The present invention relates generally to the interaction of fluids with a blood vessel, but not by way of limitation, to the field of medical equipment.

BACKGROUND OF THE INVENTION

The ability to safely and efficiently interact fluids with blood vessels has been a continued need of the medical industry for generations.

Historically, the interaction of fluids with human blood vessels has been carried out through the conjunctive use of several fundamental medical instruments which are well known and in use by practitioners in the art. While these medical instruments reliably operate to interact with blood vessels, the safety and efficiency of using the instruments continues to pose a problem for the medical industry.

Accordingly, there is a continuing need for improved instruments and methods in the field of medical equipment.

SUMMARY OF THE INVENTION

In accordance with the exemplary embodiments, a preferred vein presentation enhancement device includes at least, an interior cover supporting a first fastening member, and an exterior cover communicating with the interior cover, wherein the exterior cover provides a first securement member that interacts with the first fastening member to secure the preferred device positioned about a limb of a subject. The preferred further includes a bladder formed between the interior and exterior covers, and an air transfer assembly connected to said bladder for transfer of air into and out of said bladder, wherein said interior and exterior covers collectively provide a plurality of projections defining a blood access window.

In an alternate preferred the vein presentation enhancement device is formed by steps that includes at least, providing an interior cover supporting a first fastening member, obtaining an exterior cover configured for communication with the interior cover, in which the exterior cover provides a first securement member, forming a bladder between said interior and exterior covers, and connecting an air transfer assembly to said bladder for transfer of air into and out of said bladder, wherein said interior and exterior covers collectively provide a plurality of projections defining a blood access window.

These and various other features and advantages which characterize the claimed invention will be apparent from reading the following detailed description and a review of the associated drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a partial cutaway top plan view of an exemplary embodiment of the novel blood channeling apparatus.

FIG. **2** is a partial cutaway bottom plan view of the exemplary embodiment of the novel blood channeling apparatus of FIG. **1**.

FIG. **3** is a cross-section side elevation view of the blood channeling apparatus at section line A-A of the exemplary embodiment, of FIG. **2**.

FIG. **4** is a cross-section side elevation view of the blood channeling apparatus at section line B-B of the exemplary embodiment, of FIG. **2**.

FIG. **5** is a side elevation view of an intravenous catheter in an exemplary embodiment.

FIG. **6** is a side elevation view of the intravenous catheter of FIG. **5**.

FIG. **7** is a partial cutaway elevation view of the syringe in an exemplary embodiment.

FIG. **8** is a partial cutaway elevation view of the syringe of FIG. **7**.

FIG. **9** is a top plan view of the hollow cylinder of the syringe of FIG. **7**.

FIG. **10** is a bottom plan view of the stem of the syringe of FIG. **7**.

FIGS. **11** & **11**A show an elevation view of a container in an exemplary embodiment.

FIG. **12** is a cross-section elevation view of the container of FIG. **11**.

FIG. **13** is an elevation view of the bidirectional luer of the container of FIG. **12**.

FIG. **14** is a cross-section elevation view of the bidirectional luer of the container of FIG. **12**.

FIG. **15** is a cross-section elevation view of the bidirectional luer of the container of FIG. **12**.

FIG. **16** is a cross-section elevation view of the bidirectional luer of the container of FIG. **12**.

FIG. **17** is a perspective view of a blood vessel access kit in an exemplary embodiment.

FIG. **18** is a perspective view of a blood vessel access kit in an alternate exemplary embodiment.

FIG. **19** is a partial cross-section elevation view of an alternate embodiment of the inventive exemplary embodiment of FIG. **5**.

FIG. **20** is a partial cross-section elevation view of the alternate embodiment of FIG. **19** showing an advancement of a novel vacuum vile.

FIG. **21** is a partial cross-section elevation view of the alternate embodiment of FIG. **19** showing full advancement of the novel vacuum vile of FIG. **20**.

FIG. **22** is a partial cross-section elevation view of the alternate embodiment of FIG. **19** showing a full retracted needle and separated novel vacuum vile of FIG. **21**.

FIG. **23** is a partial cutaway top plan view of the blood channeling apparatus in an alternate exemplary embodiment.

FIG. **24** is a partial cutaway bottom plan view of the alternate exemplary embodiment of the novel blood channeling apparatus of FIG. **23**.

FIG. **25** is a flow diagram disclosing an exemplary method of using the inventive blood vessel access kit Step **1** through Step **9** and continuing to Step **10**.

FIG. **26** is a flow diagram disclosing an exemplary method of using the inventive blood vessel access kit Step **10** through Step **12**, and continuing to step **13** or in the alternative Step **15**.

FIG. **27** is a flow diagram disclosing an exemplary method of using the inventive blood vessel access kit Step **13** through Step **14**.

FIG. **28** is a flow diagram disclosing an exemplary method of using the inventive blood vessel access kit Step **15** through Step **18**.

FIG. **29** is a top plan view of an alternative alternate exemplary embodiment of a novel blood channeling apparatus, also referred to as a vein presentation enhancement device.

FIG. **30** is a top plan view of a conduit interface member of the alternative alternate exemplary embodiment of the novel vein presentation enhancement device of FIG. **29**.

FIG. **31** is a top plan view of a conduit interface member of the alternative alternate exemplary embodiment of the novel vein presentation enhancement device of FIG. **29**.

FIG. **32** is a view in elevation of a conduit interface member of the alternative alternate exemplary embodiment of the novel vein presentation enhancement device of FIG. **29**.

FIG. **33** is a bottom plan view of the alternative alternate exemplary embodiment of the inventive vein presentation enhancement device of FIG. **29**.

FIG. **34** is a top plan view of an extension member configured for use with the alternative alternate exemplary embodiment of the inventive vein presentation enhancement device of FIG. **29**.

FIG. **35** is a bottom plan view of the extension member of FIG. **34**.

FIG. **36** is a bottom plan view of the alternative alternate exemplary embodiment of the inventive vein presentation enhancement device of FIG. **29**.

FIG. **37** is a flow diagram of a method of using the inventive vein presentation enhancement device of FIG. **29** for starting an IV.

FIG. **38** is a flow diagram of an alternate method of using the inventive vein presentation enhancement device of FIG. **29** for drawing blood.

FIG. **39** is a top plan view of another alternate exemplary embodiment of a novel blood channeling apparatus, also referred to as a vein presentation enhancement device.

FIG. **40** is a bottom plan view of the novel blood channeling apparatus of FIG. **39**, also referred to as a vein presentation enhancement device.

FIG. **41** is a top plan view of another alternative exemplary embodiment of a novel blood channeling apparatus, also referred to as a vein presentation enhancement device.

DETAILED DESCRIPTION OF THE INVENTION

Exemplary embodiments of the present invention are generally directed to a blood vessel access kit configured to facilitate a transfer of fluids with a predetermined blood vessel. Reference will now be made in detail to the presently exemplary embodiments of the invention, one or more examples of which are illustrated in the accompanying drawings. Each example is provided by way of explanation of the invention, not limitation of the invention. In fact, it will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the scope or spirit of the invention. For example, features illustrated or described as part of one embodiment, can be used on another embodiment to yield a still further embodiment. Thus, it is intended that the present invention cover such modifications and variations as come within the scope of the appended claims and their equivalents. Additionally, the numbering of components in the drawings is consistent throughout the application, with the same components having the same number in each of the drawings.

FIG. **1** shows an exemplary blood channeling apparatus **100** of an exemplary embodiment, also referred to herein as a vein presentation enhancement device **100**. The exemplary blood channeling apparatus **100** includes an interior cover **102** secured to an exterior cover **104**. The exterior cover **104** supports a first securement member **106** and a first fastening member **108**. A bladder **110** is disposed between the interior cover **102** and the exterior cover **104**. The bladder **110** serves to apply pressure to the extremity to encourage additional blood into a blood vessel of interest to accommodate the insertion of an intravenous ("IV") catheter into the blood vessel of interest.

To facilitate pressure build up and withdrawal, an air transfer assembly **112** communicates with the bladder **110**. The air transfer assembly **112** includes at least an inflation mechanism **114**, which may be of a manual or mechanical type; a valve **116**, which selectively controls air flow into and out of the bladder **110**; and a gauge **118**, which may be of an analog or digital type and is provided to alert the practitioner to the amount of pressure present in the bladder **110**.

In an exemplary embodiment, the interior cover **102** and exterior cover **104** join to form a plurality of projections **120** that define a window **122**. In an exemplary embodiment, at least one attachment tab **124** is secured to one of the plurality of projections **120** and is configured for engagement with the first fastening member **108** secured to a corresponding projection **120**, of the plurality of projections **120**.

FIG. **2** displays a bottom plan view of the exemplary blood channeling apparatus **100** of the exemplary embodiment. A second fastening member **126** is shown secured to the interior cover **102** of the exemplary blood channeling apparatus **100**. The second fastening member **126** of the interior cover **102** is preferably configured to connect to the first securement member **106** of the exterior cover **104** to allow the exemplary blood channeling apparatus **100** to surround an extremity of a patient.

FIG. **3** shows a view of section A-A of the exemplary blood channeling apparatus **100** in an exemplary embodiment of FIG. **2**, indicative of a form consistent with the exemplary blood channeling apparatus **100** enclosing an appendage of a patient, at a distal end of a patient's appendage and adjacent an extremity of that appendage. Preferably, the window **122** of the exemplary blood channeling apparatus **100** can accommodate various dimensional sizes by varying an amount of overlap of a second securement member **128** (secured to the attachment tab **124**), relative to the first fastening member **108** as seen by FIG. **4**. Further in an exemplary embodiment, the first and second fastening members **108**, **126** are loop portions of a hook and loop fastening system, while the first and second securement members **106**, **128** are hook portions of a hook and loop fastening system. It is noted however that alternate fastening systems are contemplated, based on the specific use environment of the exemplary blood channeling apparatus **100**. Preferably, the exemplary blood channeling apparatus **100** confines an extremity of a patient via the connection of the first securement member **106** and the second fastening member **126**.

FIG. **4** shows a view of section B-B of the exemplary blood channeling apparatus **100** in an exemplary embodiment of FIG. **2**, indicative of a form consistent with the exemplary blood channeling apparatus **100** enclosing an appendage of a patient, at a distal end of a patient's appendage and adjacent an extremity of that appendage. The attachment tab **124** of the exemplary blood channeling apparatus **100** is shown preferably configured to size the window **122**. In an exemplary embodiment, a plurality of attachment tabs **124** can be connected to their corresponding first fastening member **108** of projection **120** of the interior and exterior covers **102** and **104**, to provide several possible window sizes. Again, the size of the window **122** is determined by an amount of overlap of the second securement member **128** relative to the first fastening member **108**.

FIG. **5** shows an exemplary intravenous catheter **200**, which preferably includes at least a fluid chamber **202** that provides at least one conduit **204** and diaphragm housing **206**. In an exemplary embodiment, the diaphragm housing **206** is located on the proximal end of the fluid chamber **202**, and catheter **208** secured to the distal end of the fluid chamber **202**. In a further exemplary embodiment, a needleless valve **210** communicates with the fluid chamber **202** via a fluid transfer tube **211** secured to and disposed between the conduit **204** and the needleless valve **210**. The CLAVE® Connector with luer lock, such as those manufactured by ICU Medical Inc. of San Clemente Calif., has been found to be suitable as the needleless valve **210**.

FIG. **5** further shows the fluid chamber **202** of the exemplary intravenous catheter **200** preferably has a securement member **212** adjacent the diaphragm housing **206**. Preferably, a diaphragm **214** is confined in the diaphragm housing **206**, and is configured to allow passage of a hypodermic needle **216**, which extends from a needle transport **218** through the diaphragm **214**, the fluid chamber **202**, and the catheter **208** when the exemplary intravenous catheter **200** is configured for insertion into a predetermined blood vessel of a patient. The needle transport **218** includes a needle confinement feature **220**, which interacts with a needle safety catch feature **224** to secure the hypodermic needle **216** within a needle confinement housing **222**, once the hypodermic needle **216** has been extracted from the diaphragm **214**.

FIG. **6** shows the needle transport **218** of the exemplary intravenous catheter **200** preferably includes a plurality of isolation diaphragms **226** configured to enclose first and second fluid ports **228** and **230** of the hypodermic needle **216**, when the needle confinement feature **220** is secured by the needle safety catch feature **224**. Further in an exemplary embodiment, a grip portion **232** is provided by the needle transport **218** to facilitate sliding communication of the needle transport **218** with the needle confinement housing **222**.

FIG. **7** shows an exemplary syringe **300** in an exemplary embodiment. The exemplary syringe **300** preferably comprises a hollow cylinder **302**, shown in partial cut-away, which provides a support flange **304** on a proximal end of the hollow cylinder **302**. In an exemplary embodiment, a piston **306** that includes at least a seal portion **308** positioned on a distal end and in sliding contact with an internal surface **310** (shown in FIG. **8**) of the hollow cylinder **302**, a piston activation member **312** on a proximal end, and a stem **314** disposed between the seal portion **308** and the piston activation member **312**. The piston **306** selectively serves to draw fluids in and expel fluids from the hollow cylinder **302**. In an exemplary embodiment, the stem provides a plurality of calibration notches **316**, which when positioned into alignment with a stem control member **318**, provided by the support flange **304**, controls transfer of a precise volume of fluid drawn in or expelled from the hollow cylinder **302**.

FIG. **8** further shows the exemplary syringe **300** of an exemplary embodiment includes a tapered portion (also referred to herein as a luer) **320** and a securement member **322** at the distal end of the hollow cylinder **302**. The luer **320** and securement member **322** are at least configured to interact with a needleless valve **210** (of FIG. **5**). FIG. **9** shows a top plan view of the hollow cylinder **302** of the exemplary syringe **300** in an exemplary embodiment. The stem control member **318** of the exemplary syringe **300** is preferably formed from a material, such as spring steel, but may be formed of any material that provides a spring like response, and is secured to, formed in or formed with the support flange **304** of the hollow cylinder **302**. Preferably, the stem control member **318** interacts with the calibration notches **316** to control displacement of the piston **306** in the hollow cylinder **302**.

FIG. **10** displays a bottom plan view of the piston **306** of the exemplary syringe **300** in an exemplary embodiment. The stem **314** of the exemplary syringe **300** preferably includes a plurality of fins **324** in which the calibration notches **316** are preferably located on at least two of the plurality of fins **324**, while at least one alternate fin **324** of the plurality of fins **324** provide a land **326**. In an exemplary embodiment, when the land **326** is aligned with the stem control member **318** (of FIG. **8**), the piston **306** is free to move unencumbered within the hollow cylinder **302** (of FIG. **8**), having only the sliding friction developed between the seal portion **308** and the internal surface **310** (shown in FIG. **8**) of the hollow cylinder **302** to overcome.

FIG. **11** shows an exemplary container **400** of the exemplary embodiment that preferably includes at least a seal housing **402** supporting an access seal **404**, which prevents inadvertent access to the interior of the seal housing **402**. In an exemplary embodiment, the seal housing **402** is secured to a diaphragm **406** (also referred to herein as an inline coupling **406**), which preferably surrounds a portion of a test tube **408** to form a vacuum seal **407** with the test tube **408** and present a vacuum charged blood collection tube.

FIG. **11A** shows the seal housing **402** of the exemplary container **400** is operatively connectable to at least the needleless valve **210** preferably via luer lock threads **409** provided by the needleless valve **210**. In an exemplary embodiment, the seal housing **402** is secured to a diaphragm **406** (also referred to herein as an inline coupling **406**), which preferably surrounds a portion of the test tube **408** to present a vacuum blood collection tube. Preferably, the inline coupling **406** of the exemplary container **400** forms a vacuum seal **407** with the test tube **408**.

FIG. **12** displays the exemplary container **400** in an exemplary embodiment that includes a bidirectional tapered luer **410** secured within the seal housing **402**. The bidirectional tapered luer **410** is held in abutting adjacency against a resilient seal **412** by a plurality of retention fingers **414**, provided by the seal housing **402**, interacting with an annular retention collar **416** of the bidirectional tapered luer **410**. In an exemplary embodiment, the seal housing **402** comprises a conduit **418** surrounded by the resilient seal **412**. The conduit **418** of the exemplary container **400** further preferably comprises a fluid access port **420**.

In an operative mode, upon an engagement of the needleless valve **210** by the exemplary container **400**, the bidirectional tapered luer **410** interacts with a resilient seal **422** of the needleless valve **210** to expose a fluid port **424** of the needleless valve **210** in preparation for a transfer of fluid through a fluid tube **426** of the needleless valve **210**. Upon further engagement of the exemplary container **400** with the needleless valve **210**, the bidirectional tapered luer **410** interacts with the resilient seal **412** of the seal housing **402** to expose the fluid access port **420** of the conduit **418**, which exposes the vacuum environment within the test tube **408** to pull fluid from the fluid tube **426** into the test tube **408**. When pressure is equalized between the test tube **408** and the fluid tube **426**, the exemplary container **400** is disengaged from the needleless valve **210** and the respective resilient seals **412** and **422** close off their respective fluid ports **420** and **424**.

FIG. **13** shows the bidirectional tapered luer **410** of the exemplary container **400** (of FIG. **12**) includes a first tapered end **428**, a second tapered end **430**, and a luer seating ridge **432**. In an exemplary operating environment a vacuum is drawn on the test tube **408** (of FIG. **12**) via the fluid port **420** (of FIG. **12**), then the bidirectional tapered luer **410** is posi-

tioned within the seal housing **402** (of FIG. **12**) such that the retention fingers **414** engage the retention collar **416**, which positions the second tapered end **430** adjacent the resilient seal **412** (of FIG. **12**) and confines the bidirectional tapered luer **410** within the seal housing **402**.

When the exemplary container **400** initially engages the needleless valve **210** (of FIG. **12**), the first tapered end **428** of the bidirectional tapered luer **410** contacts the resilient seal **422** (of FIG. **12**), and as the engagement of the exemplary container **400** with the needleless valve **210** progresses, the retention fingers **414** encounter the luer seating ridge **432** as shown by FIG. **14**. For exemplary embodiment **400**, preferably an amount of force required for the retention fingers **414** to pass by the luer seating ridge **432** is greater than the force needed to compress the resilient seal **422** of the needleless valve **210**, and the resilient seal **422** compresses to open the fluid port **424** (of FIG. **12**).

With continued advancement of the exemplary container **400** onto the needleless valve **210**, the first tapered end **428** of the bidirectional tapered luer **410** bottoms out against the housing of the needleless valve **210**; that is the housing encapsulating the resilient seal **422**. With further advancement of the exemplary container **400** onto the needleless valve **210**, the retention fingers **414** overcome the luer seating ridge **432**, and second tapered end **430** compresses the resilient seal **412** of the housing **402**, which opens the fluid port **420** of the housing **402** causing the vacuum within the test tube **408** to draw fluid from the fluid tube **426** into the test tube **408**.

During fluid transfer, the retention fingers **414** are positioned, relative to the bidirectional tapered luer **410** as shown in FIG. **15**, and upon disengagement of the exemplary container **400** from the needleless valve **210**, the retention fingers **414** engage a top side of the luer seating ridge **432**, as shown by FIG. **16**. In an exemplary embodiment, both the luer seating ridge **432** and the retention collar **416** provide a contoured bottom surface and a flat top surface. The contoured bottom surface accommodates passage of the retention fingers **414** by the luer seating ridge **432** and the retention collar **416**, while the flat top surfaces inhibit passage of the retention fingers **414** by the luer seating ridge **432** and the retention collar **416**. Accordingly, when the retention fingers **414** are adjacent the flat surfaces, of either the luer seating ridge **432** or the retention collar **416**, the bidirectional tapered luer **410** will remain confined within the housing **402**. Removal of the bidirectional tapered luer **410** from the housing **402** is accomplished by encouraging the retention fingers **414** away from the luer seating ridge **432** or the retention collar **416** as the case may be.

FIGS. **17** and **18** show a perspective view of an exemplary blood vessel access kit **500**. The exemplary blood vessel access kit **500** preferably includes the exemplary blood channeling apparatus **100** engaging the appendage **502** of a patient. The air transfer assembly **112** is preferably displayed configured to supply air to the exemplary blood channeling apparatus **100**. Further in an exemplary embodiment, a tourniquet **504** restricts venous blood flow of the patient. The exemplary intravenous catheter **200** is illustrated communicating with a blood vessel of the patient. The needle confinement housing **222** is preferably shown restricting the needle transport **218**. Preferably, the exemplary syringe **300** or the exemplary container **400** is mutually distinct in the ability to transfer fluids from a blood vessel of the patient.

FIG. **19** shows an alternate exemplary intravenous catheter **600**, which preferably includes at least a fluid chamber **202** that provides at least one conduit **204** and diaphragm housing **206**. In an exemplary embodiment, the diaphragm housing **206** is located on the proximal end of the fluid chamber **202**, and the catheter **208** is secured to the distal end of the fluid chamber **202**. In a further exemplary embodiment, a needleless valve **210** communicates with the fluid chamber **202** via a fluid transfer tube **211** secured to and disposed between the conduit **204** and the needleless valve **210**. The CLAVE® Connector with luer lock, such as those manufactured by ICU Medical Inc. of San Clemente Calif., has been found to be suitable as the needleless valve **210**.

FIG. **19** further shows the fluid chamber **202** of the alternate exemplary intravenous catheter **600** preferably has a securement member **212** adjacent the diaphragm housing **206**. The alternate exemplary intravenous catheter **600**, includes a diaphragm **214** confined in the diaphragm housing **206**, and configured to allow passage of a hypodermic needle **216**, which extends from a needle transport **218** through the diaphragm **214**, the fluid chamber **202**, and the catheter **208** when the alternate exemplary intravenous catheter **600** is configured for insertion into a predetermined blood vessel of a patient. The needle transport **218** includes a needle confinement feature **220**, which interacts with a needle safety catch feature **224** to secure the hypodermic needle **216** within a needle confinement housing **602**, once the hypodermic needle **216** has been extracted from the diaphragm **214**.

The alternate exemplary intravenous catheter **600** further includes an exemplary vacuum vessel assembly **604** fitted within and constrained by the needle confinement housing **602** through the use of a securement key **606**. Upon removal of the securement key **606**, the exemplary vacuum vessel assembly **604** may be advanced relative to the hypodermic needle **216** until the hypodermic needle **216** penetrates through a self-sealing diaphragm **608** fitted within a rigid test tube shaped vessel **610**.

The rigid test tube shaped vessel **610** provides access to a vacuum environment provided by the exemplary vacuum vessel assembly **604** of the alternate exemplary intravenous catheter **600**. To advance the rigid test tube shaped vessel **610**, the exemplary vacuum vessel assembly **604** further provides an advancement tab assembly **612**, which interacts with a slide channel **614** provided by the needle confinement housing **602** of the alternate exemplary intravenous catheter **600**.

FIG. **20** shows that as an advancement force is applied to the advancement tab assembly **612** of the exemplary vacuum vessel assembly **604**, the advancement tab assembly **612** progresses along the slide channel **614**. The progression of the advancement tab assembly **612** along the slide channel **614** imparts both a rotational motion and a lateral motion on the rigid test tube shaped vessel **610** relative to the hypodermic needle **216**. The collective motions of the rigid test tube shaped vessel **610** promote penetration of the self-sealing diaphragm **608** by the hypodermic needle **216**.

FIG. **21** shows the advancement tab assembly **612** of the exemplary vacuum vessel assembly **604** in its maximum advancement position. The advancement tab assembly **612** is shown to include at least a slide shaft **616**, that interacts directly with the slide channel **614**, and an appendage platform **618** secured to the slide shaft **616**. When the advancement tab assembly **612** has attained its maximum extent, the slide shaft **616** is positioned in a second slide channel, which accommodates the exodus of the exemplary vacuum vessel assembly **604** from the needle confinement housing **602** at the conclusion of the medical procedure.

FIG. **22** shows the needle transport **218** of the alternate exemplary intravenous catheter **600** preferably includes a plurality of isolation diaphragms **226** configured to enclose first and second fluid ports **228** and **230** of the hypodermic needle **216**, when the needle confinement feature **220** is secured by the needle safety catch feature **224**. Further in an

exemplary embodiment, a grip portion **232** is provided by the needle transport **218** to facilitate sliding communication of the needle transport **218** with the needle confinement housing **602**.

FIG. **23** shows an alternative exemplary blood channeling apparatus **700** of an exemplary embodiment. The alternative exemplary blood channeling apparatus **700** includes an interior cover **702** secured to an exterior cover **704**. The exterior cover **704** supports a first securement member **106** and a first fastening member **108**. Upon sealing the interior cover **702** secured to the exterior cover **704**, an air bladder is formed therebetween. The bladder serves to apply pressure to the extremity of a patient to encourage additional blood into a blood vessel of interest to accommodate the insertion of an intravenous ("IV") catheter into the blood vessel of interest.

To facilitate pressure build up and withdrawal, an air transfer assembly **112** communicates with the formed bladder. The air transfer assembly **112** includes at least an inflation mechanism **114**, which may be of a manual or mechanical type; and a valve **116**, which selectively controls air flow into and out of the formed bladder.

In an exemplary embodiment, the interior cover **702** and exterior cover **704** join to form a plurality of projections **120** that define a window **122**. In an exemplary embodiment, at least one attachment tab **124** is secured to one of the plurality of projections **120** and is configured for engagement with the first fastening member **108** secured to a corresponding projection **120**, of the plurality of projections **120**.

FIG. **24** displays a bottom plan view of the alternative exemplary blood channeling apparatus **700** of the exemplary embodiment. A second fastening member **126** is shown secured to the interior cover **702** of the alternative exemplary blood channeling apparatus **700**. The second fastening member **126** of the interior cover **702** is preferably configured to connect to the first securement member **106** of the exterior cover **704** to allow the alternative exemplary blood channeling apparatus **700** to surround an extremity of a patient.

The flow charts, FIGS. **25** through **28**, disclose an exemplary method of using the inventive blood vessel access kit. FIG. **25** shows the exemplary process **800** to commence at process Step **1**, with the application of a tourniquet to a patient. At process Step **2**, prepare a needle for use. At process Step **3**, saline is advanced into the needle. Venipuncture is attempted at process Step **4**. In process Step **5**, create a vacuum in the needle and catheter apparatus. At process Step **6**, operator looks for a flash of blood into the catheter. In process Step **7** A, a flash of blood is observed. In the alternative, in process Step **7** B, the needle is maneuvered until a flash of blood is observed (of process Step **7** A). After the flash of blood is observed (of process Step **7** A), the needle tip is held stationary while positioning the catheter in process Step **8**. In process step **9**, the catheter is advanced over the needle and into the punctured vein. Process Step **10** continues in FIG. **26**.

In FIG. **26**, process Step **10** A shows the catheter advances into the vein. In the alternative, in process Step **10** B, the catheter fails to advance easily and the operator maneuvers the catheter so that it will advance. Process Step **11** shows that proper placement of the advanced catheter (of process Step **10** A) can be verified once the catheter is advanced into the vein. In process Step **12** A, blood is withdrawn, and the exemplary process **800** continues at process Step **15**. In the alternative, in process Step **12** B, no withdraw or flash of blood is observed, so the catheter is repositioned, and the exemplary process **800** continues at process Step **13** in FIG. **27**.

In FIG. **27**, process Step **13** A shows catheter is repositioned after seeing a flash of blood and in process Step **14** A the catheter easily advances so the operator continues from process Step **11** (of FIG. **26**), or in the alternative if the catheter resists advancement the operator may need to continue with process Step **10** B (of FIG. **26**), process Step **3** (of FIG. **25**), or process Step **1** (of FIG. **25**). In the alternative, in process Step **13** B, no flash of blood is observed so the operator returns to process Step **7** B (of FIG. **25**).

In FIG. **28**, process Step **15** shows infusion locking position is achieved and the tourniquet is removed. At process Step **16**, the needle is withdrawn into a safety shield. In process Step **17**, the safety shield is disposed of in a sharps container. At process Step **18**, the catheter is secured to the patient.

While the process Steps of exemplary process **800** are meant to be exemplary, numerous changes to the Steps, and also the sequencing of the Steps, may be made which will readily suggest themselves to those skilled in the art and which are encompassed by the appended claims.

FIG. **29** shows a top plan view of a preferred vein presentation enhancement device **820**, which includes at least an exterior cover **822** that provides a first securement member **824** supported by a web **826**. In a preferred embodiment, the web **826** is formed from a polyvinylchloride ("PVC") material, and the first securement member **824** is the loop portion of a hook and loop fastening system formed from a polymer and adhered to the web **826**. FIG. **29** further shows that the exterior cover **822** preferably provides an access aperture **828** through which a conduit interface member **830** is feed-through from the back side and secured to the web **826** by a heat seal **832**. FIGS. **30**, **31**, and **32** respectively show the preferred conduit interface member **830** in a top plan view, bottom plan view, and view in elevation, which is preferably formed from PVC. The stitching **834**, shown in FIG. **29** is a preferred means of securing a preferred first fastening member **836** (shown by FIG. **33**) to each an interior cover **838** (of FIG. **33**), and the exterior cover **822**.

As further shown by FIG. **33**, the interior cover **838** provides a patient contact material **840** supported by a web **842**. In a preferred embodiment, the web **842** is formed from a PVC material; the patient contact material **840** is formed from cotton and adhered to the web **842**. Preferably, the first fastening member **836** provided the hook portion of a hook and loop fastening system, and is formed from a polymer. In a preferred embodiment, the interior cover **838** is secured to the exterior cover **822** by a heat seal **844** and a plurality of strain relief features **846**. A preferred result of completion of the heat seal process is the formation of an air tight bladder **848**, and at least two projections **850**, which collectively define a blood access window **852**.

The vein presentation enhancement device **820**, is preferably configured such that when wrapped in secure contact around a limb of a patient with the first fastening member **836** secured to the first securement member **824**, upon inflating the bladder the first fastening member **836** will self release from the first securement member **824** at a pressure of about 195 to 220 mmHg, thereby mitigating an ill effect of overinflating the vein presentation enhancement device **820**.

FIG. **34** shows a top plan view of a preferred extension member **854** for the vein presentation enhancement device **820**, which includes at least an exterior extension cover **856** that provides a second securement member **858** supported by an exterior extension web **860**. In a preferred embodiment, the exterior extension web **860** is formed from a PVC material, and the second securement member **858** is the loop portion of a hook and loop fastening system formed from a polymer and adhered to the exterior extension web **860**. The stitching **862**, shown in FIG. **34** is a preferred means of

securing a preferred second fastening member **866** (shown by FIG. **35**) to each an interior extension cover **868** (of FIG. **35**), and the exterior extension cover **856**.

As further shown by FIG. **35**, the interior extension cover **868** provides a patient contact extension material **870** supported by an interior extension web **872**. In a preferred embodiment, the interior extension web **872** is formed from a PVC material; the patient contact extension material **870** is formed from cotton and adhered to the interior extension web **872**. Preferably, the second fastening member **866** provided the hook portion of a hook and loop fastening system, and is formed from a polymer. In a preferred embodiment, the interior extension cover **868** is secured to the exterior extension cover **856** by a heat seal **874**.

FIG. **36** shows the preferred vein presentation enhancement device **820** secured to the preferred extension member **854**. To facilitate this securement, the first fastening member **836** of the vein presentation enhancement device **820** provides the hook portion of a hook and loop fastening system, and the second securement member **858** of the extension member **854** provides the loop portion of the hook and loop fastening system. The result of adding the extension member **854** to the preferred vein presentation enhancement device **820** is an accommodation of various limbs, or portion of limbs, of patients. With the extension member **854** attached, the inflatable tourniquet (vein presentation enhancement device **820**) becomes functional by securing the second fastening member **866** (of FIG. **35**) to the first securement member **836** (of FIG. **33**)

FIG. **37** illustrates a flow diagram of a method of using the inventive vein presentation enhancement device **820** (of FIG. **29**), in starting an IV in a patient, while FIG. **38** shows a flow diagram of an alternate method of using the inventive vein presentation enhancement device **820** of FIG. **29** in drawing blood from a patient.

FIG. **39** shows a top plan view of a preferred vein presentation enhancement device **876**, which includes at least an exterior cover **878** that provides a first securement member **880** supported by a web **882**. In a preferred embodiment, the web **882** is formed from a polyvinylchloride ("PVC") material, and the first securement member **880** is the loop portion of a hook and loop fastening system formed from a polymer and adhered to the web **882**. FIG. **39** further shows that the exterior cover **878** preferably provides an access aperture **884** through which a conduit interface member **830** (of FIGS. **30**, **31**, and **32**) is feed-through from the back side of the exterior cover **878** and secured to the web **882** by a heat seal **886**. FIGS. **30**, **31**, and **32** respectively show the preferred conduit interface member **830** in a top plan view, bottom plan view, and view in elevation, which is preferably formed from PVC. The stitching **888**, shown in FIG. **39** is a preferred means of securing a preferred fastening member **890** (shown by FIG. **40**) to each an interior cover **892** (of FIG. **40**), and the exterior cover **878**.

FIG. **39** further shows that heat seal **894** provides the external boundaries for each of the plurality of bladders, which in the present embodiment include, stage I bladder **896**, stage II bladder **898**, and stage III bladder **900**. Heat seal portion **902** forms the boundary and substantial fluidic seal between stage I bladder **896** and stage II bladder **898**, while heat seal portion **904** forms the boundary and substantial fluidic seal between stage II bladder **898** and stage III bladder **900**. To facilitate a substantially sequential filling of stage I, II, and III bladders of the present exemplary embodiment, a first fluidic conduit **906** is provided to promote passage of fluid from stage I bladder **896** to stage II bladder **898**, once the volume and pressure of fluid in stage I bladder **896** reaches a predetermined level. Likewise, a second fluidic conduit **908** is provided to promote passage of fluid from stage II bladder **898** to stage III bladder **900**, once the volume and pressure of fluid in stage II bladder **898** reaches a predetermined level. This substantial sequential inflation of bladders **896**, **898**, and **900**, serve to encourage blood into veins accessible through the vein access window **910**, while mitigating blood flow away from the vein access window **910**.

As further shown by FIG. **40**, the interior cover **892** provides a patient contact material **912** supported by a web **914**. In a preferred embodiment, the web **914** is formed from a PVC material; the patient contact material **912** is formed from cotton and adhered to the web **914**. Preferably, the fastening member **890** provided the hook portion of a hook and loop fastening system, and is formed from a polymer. In a preferred embodiment, the interior cover **8892** is secured to the exterior cover **878** by the heat seal **894** and the heat seal portions **902** and **904**. A preferred result of completion of the heat seal process is the formation of bladders **896**, **898**, and **900**, which collectively an air tight composite bladder **916** that includes and at least two projections **918**, which collectively define the blood access window **910**.

FIG. **41** shows an exemplary embodiment in which the first fluidic conduit **906** is positioned near the mid portion of heat seal **902**, while the second fluidic conduit **908** is disposed adjacent opposite ends of heat seal **904**. However, the functionality of fluidic conduits **906** and **908** remain consistent with the explanation provided hereinabove.

It will be clear that the present invention is well adapted to attain the ends and advantages mentioned as well as those inherent therein. While presently exemplary embodiments have been described for purposes of this disclosure, numerous changes may be made which will readily suggest themselves to those skilled in the art and which are encompassed by the appended claims.

What is claimed is:

1. A vein presentation enhancement apparatus comprising:
- an interior cover supporting a fastening member;
- an exterior cover communicating with said interior cover, said exterior cover providing a securement member;
- an air tight composite bladder formed between said interior and exterior covers, wherein the air tight composite bladder comprises a stage I bladder, a stage II bladder, and stage III bladder;
- a first fluidic conduit disposed between the stage I bladder and the stage II bladder, wherein the first fluidic conduit promotes passage of fluid from the stage I bladder to the stage II bladder once the volume and pressure of fluid in the stage I bladder reaches a predetermined level;
- a second fluidic conduit disposed between the stage II bladder and the stage III bladder, wherein the second fluidic conduit promotes passage of fluid from the stage II bladder to the stage III bladder once the volume and pressure of fluid in the stage II bladder reaches a predetermined level;
- a vein access window adjacent to the stage III bladder; and
- an air transfer assembly connected to the stage I bladder for transfer of transferring air into and out of the air tight composite bladder, wherein the transfer of air into the air tight composite bladder sequentially inflates the stage I bladder, the stage II bladder, and the stage III bladder.

2. The vein presentation enhancement apparatus of claim **1**, wherein the securement member comprises a hook portion of a hook and loop fastening system.

3. The vein presentation enhancement apparatus of claim **1**, wherein said fastening member is loop portions of a hook and loop fastening system.

4. The vein presentation enhancement apparatus of claim 1, further comprising a plurality of bladder boundary structures, said boundary structures secure said interior cover to said exterior cover.

5. The vein presentation enhancement apparatus of claim 1, wherein said air transfer assembly comprises:

an inflation mechanism;

a valve secured to said inflation mechanism; and

a conduit disposed between said inflation mechanism and said stage I bladder, said conduit transferring air between said inflation mechanism and said stage I bladder.

6. The vein presentation enhancement apparatus of claim 1, wherein the sequential inflation of the stage I bladder, the stage II bladder, and the stage III bladder encourages a user's blood into veins accessible through the vein access window while mitigating blood flow away from the vein access window.

7. The vein presentation enhancement apparatus of claim 1, wherein upon surrounding a limb of a subject with the air tight composite bladder such that said interior cover is directly adjacent said limb and upon securing said fastening member to said securement member a pneumatic tourniquet is formed.

8. The vein presentation enhancement apparatus of claim 1, further comprising a conduit interface member secure to said exterior cover and communicating with said air transfer assembly to facilitate said transfer of air into and out of the air tight composite bladder.

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